AMERICAN JOURNAL OF ORTHODONTICS

OFFICIAL PUBLICATION OF
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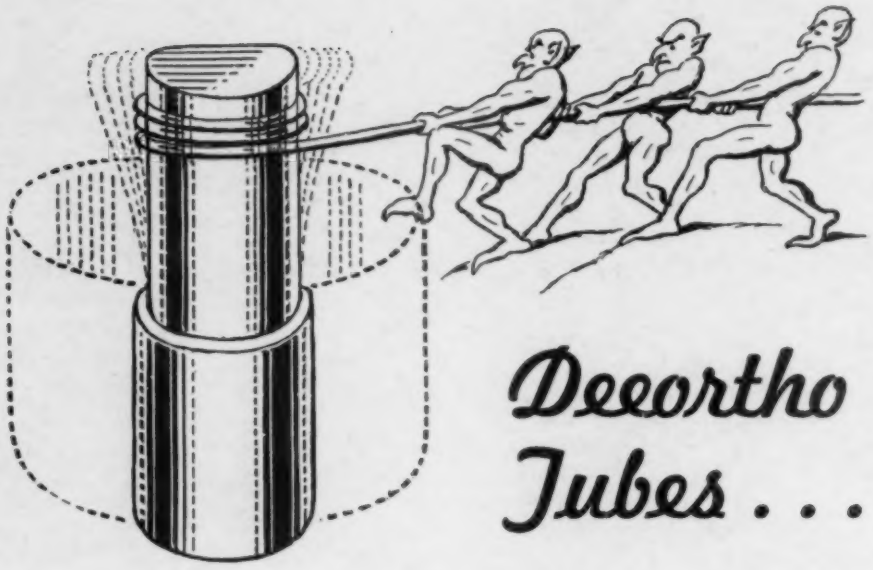
VOL. 36 **AUGUST, 1950** **No. 8**



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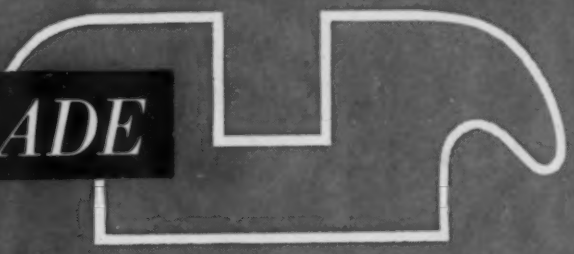

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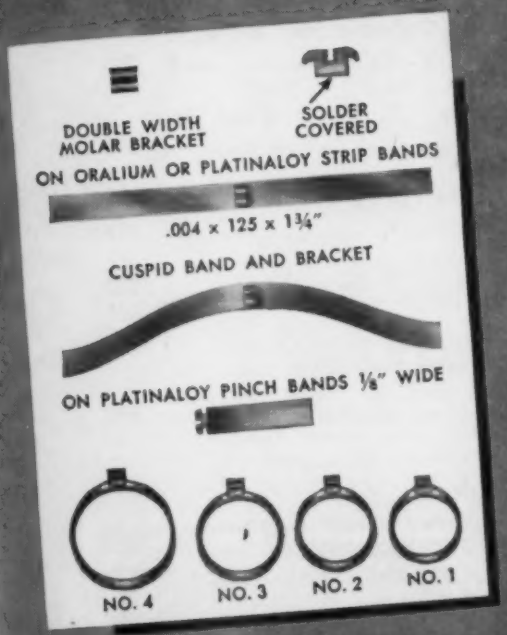

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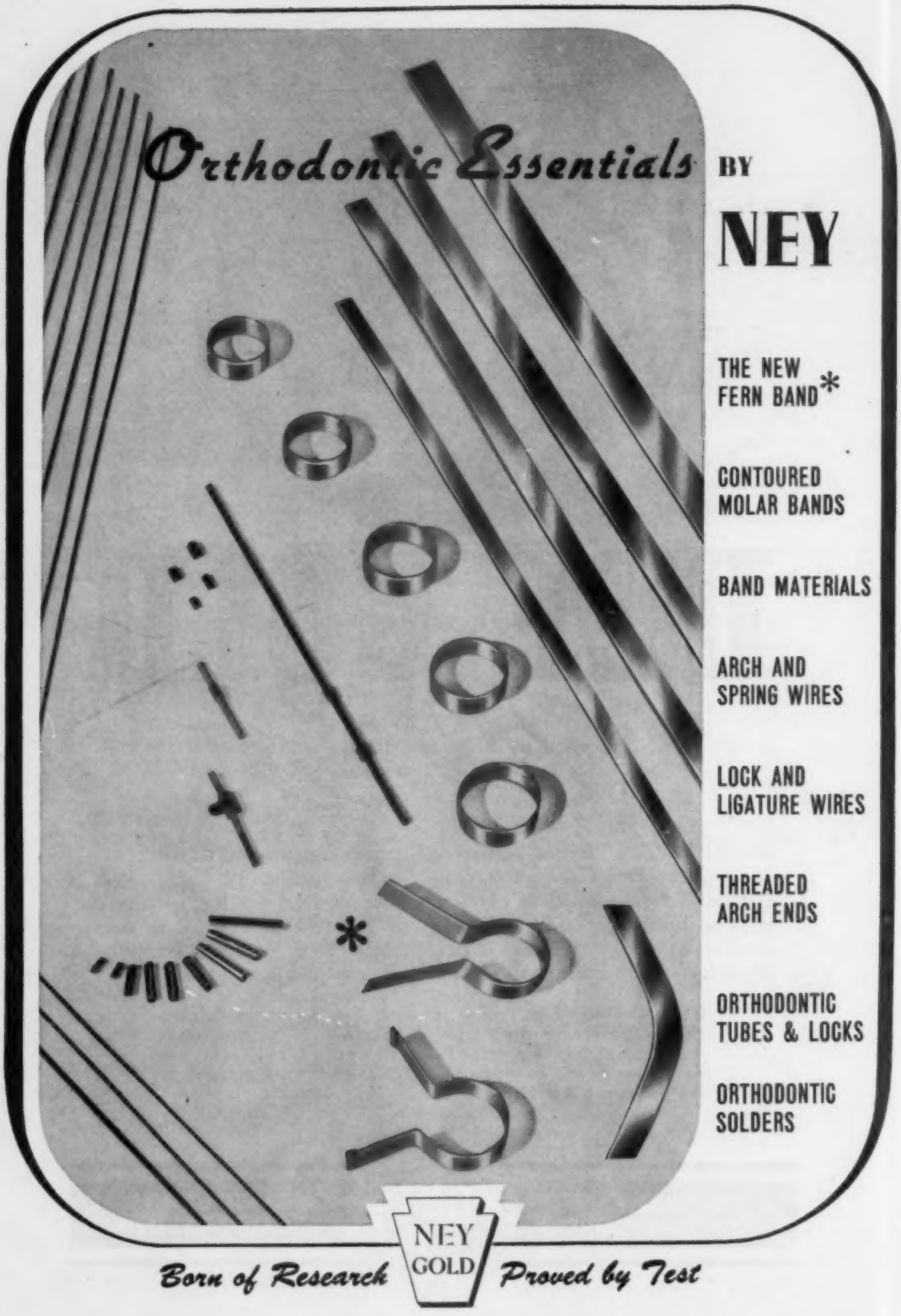

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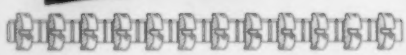

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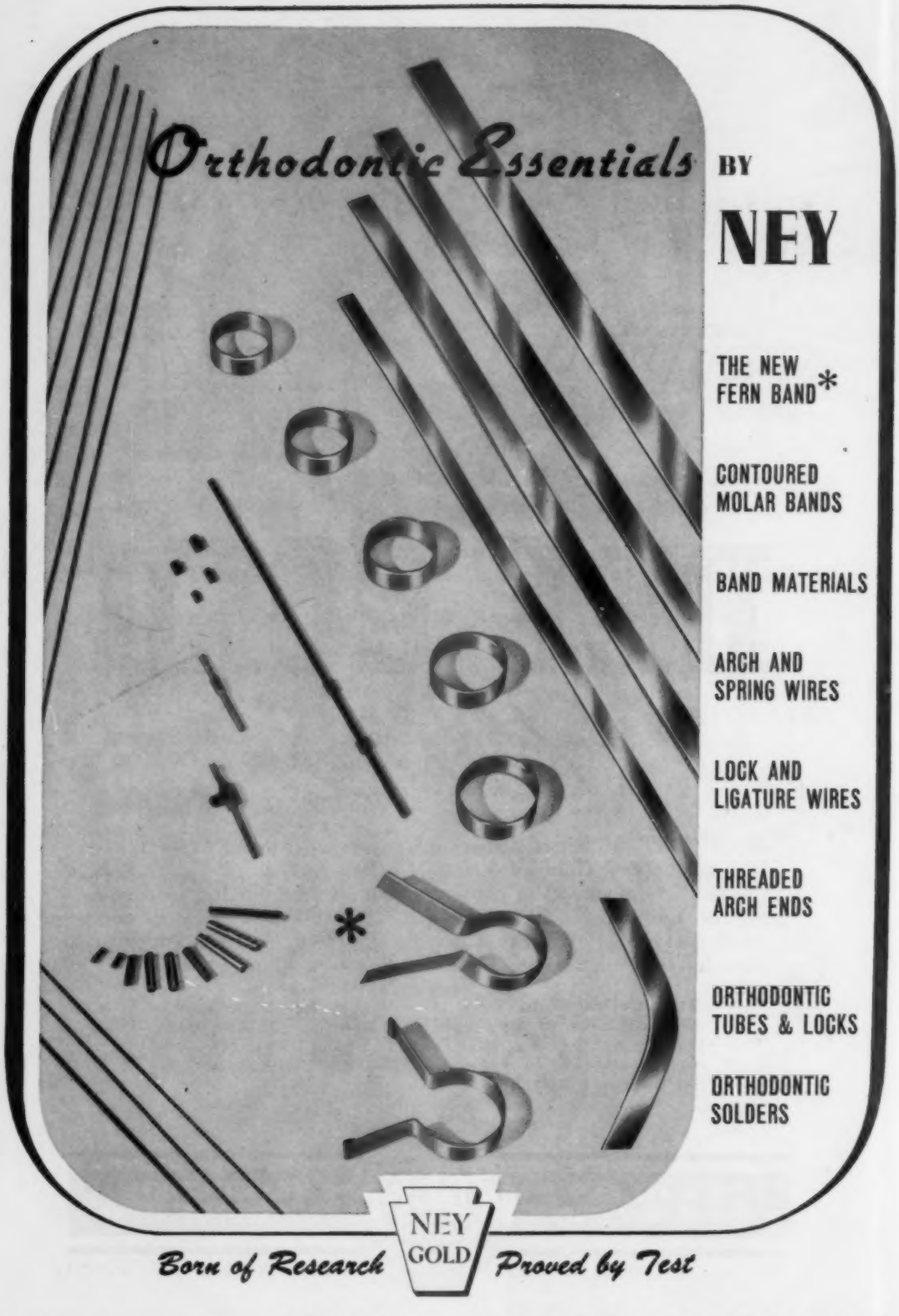

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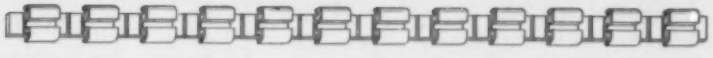

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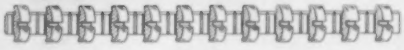

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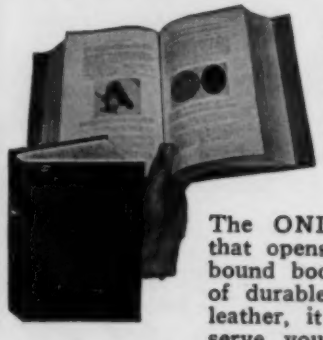

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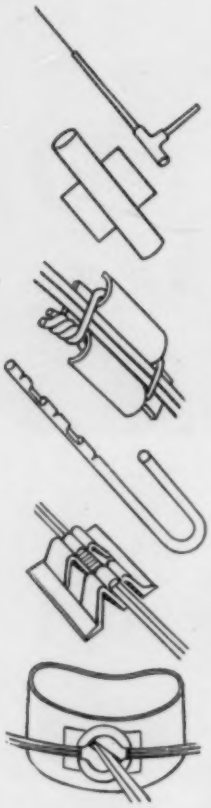

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VOL. 36 AUGUST, 1950 NO. 8

Original Articles

EUROPEAN SOCIAL ORTHODONTICS

HOWARD E. STRANGE, D.D.S., M.S.D., CHICAGO, ILL.

ALL that has happened in Europe is too solemn, too significant, and certainly too complicated for me to write or speak about so formlessly—and so hastily. When I returned to America and saw my country again, and felt its mind and temper a little, I said, "It is later than you think."

Being a curious American citizen, and having received a small portion of my early education in Norway and England in the days when times and conditions were less uncertain and confused, I was intent on visiting friends, relatives, and familiar places. Possibly I may have been stimulated or conditioned for travel by the following poignant paragraph in Montaigne's essay on education:

> And for this reason, conversation with men is of great use and travel into foreign countries: not to bring back (as most monsieurs do) an an account only of how many paces Santa Rotunda is in circuit or of the richness of Signora Livia's petticoats: or as some others, how much Nero's face, in a statue in such an old ruin, is longer and broader than that made for him on some medal; but to be able chiefly to give an account of the human manners, customs, and laws of the nations where he had been, and that we may whet and sharpen our wits by rubbing them against those of others.

Because of my inherent inquisitive mind, it was not my desire to travel about as an ordinary tourist, hitting the high spots, observing the scenery, and traversing the main thoroughfares. Consultation with bigwigs, ministers of this and that, was not my desire. Mr. Aneurin Bevan had already made up his mind. He seemed to know, and I say know advisedly, exactly what was best for the health of the British people. I wanted to feel the social, political, and economic pulse of the people, to frequent the remote spots where one has a chance to converse with people in all walks of life, the taxpayer who foots the bills for all the social schemes and ideas that, in a very subtle and insidious way, seem to kill initiative and incentive.

Presented at the meeting of the American Association of Orthodontists, Chicago, Ill., May 11, 1950.

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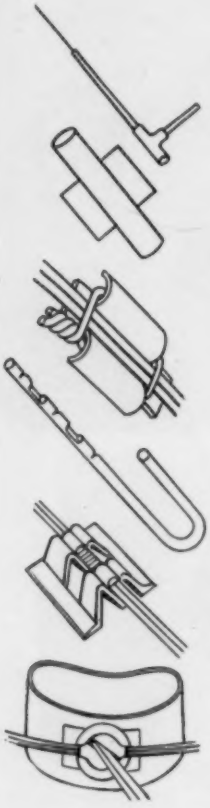

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Presented at the meeting of the American Association of Orthodontists, Chicago, Ill., May 11, 1950.

In order to be prepared for a three-month sojourn in Europe, it was necessary for me to devote a considerable portion of my leisure hours to an inclusive study of history, economics, and philosophy. Commencing with that old gadfly, Socrates, plodding through Aristotle's *Ethics,* selections from Thucydides' history and Plutarch's *Lives,* shuddering with fright when reaching Machiavelli's accounts of intrigue: "The end justifies the means," and laboriously moving onward through the illuminating writings of St. Thomas Aquinas, learning lessons in the conflict between the spirit and the flesh so adequately portrayed in *The Confessions of St. Augustine,* and studying the governmental philosophy of that great English pragmatist, John Locke, I thus began my preparation for my European journey.

Concluding with a reading of the Federalist Papers, the confusing, wretched, and defeatist treatise, *The Communist Manifesto* by Karl Marx, and a comprehensive study of our own great document of checks and balances, the masthead of freedom, The Constitution of the United States, I felt prepared to evaluate and make a few comparative analyses. The statement of Benjamin Franklin stands out clearly in my mind: "We have a republic if we can keep it." One significant factor impressed me, and as I turned thoughts over and over in my mind I asked this question: "Do we realize that Western man and his works and accomplishments are no more invulnerable than the now extinct civilizations of the Aztecs and the Incas, the Sumerians and the Hittites"? Surely, events in the drama of history are an indelible record and we have plenty of cause to wonder if our scientists, statesmen, diplomats, and others in places of high trust realize that we are not exempt from the possibility of falling into the same mistakes and errors that have been the destroying factors of other civilizations, whose recorded history is an open book.

Please understand that I am not and do not even pretend to be a philosopher, nor a historian, nor an economist, nor even a sociologist. The Bill of Rights gives us, our society, the right to assemble here and discuss our problems. Fundamentally, I and all the members and guests here assembled are vitally interested in perpetuating a system directly concerned with the dignity and worth of the human individual. For want of a better term we may define it as a system, or, better yet, a philosophy or code of living that will allow the citizens of the future, my children and your children, to enjoy the same chance that all attending this meeting have had in the past. Naturally such a philosophy is associated with world economics, and we cannot divorce our thinking from the tenet that, in a modern civilized community, the economics of the humblest home is connected with the economics of the whole world.

The word economics is derived from the Greek word meaning housekeeping. Nowadays the word has a much wider application, and economics deals with the activities by which the human race gets its living. Like charity, economics begins in the home. In the over-all picture, governments are judged by the effects of their policy upon the housekeeping of the home. If, during their term of office, household goods and other necessities for survival have been plentiful, cheap, and good, their chances for winning the next election will be good. If, on

the other hand, the goods have been scarce and very expensive, the government will be weighed in the balance and found wanting. At this precise moment please ask of yourselves this profound and fundamental question: "Has the government been a good housekeeper for the nation?" As the heads of individual households, how long would each of us survive if each one of us continued to spend beyond our individual incomes? After all, the people comprise the government, and a properly organized government should be a servant of the people, the citizenry. Fundamental principles of economics and common sense are the ponderables that supply the answer; and if at this moment you cannot balance your personal budget and you are suffering from mental rigor mortis or museum mind thinking, the sheriff's van will be removing your household effects. A process of liquidation will take place and your tangibles will go on the auction block because of unwise management and lack of thrift.

Equipped with a detailed preparation, I was ready to visit Western Europe where the people seem to be so obsessed with the "idea of security" that economic recovery is retarded. Probably events in history have produced the resultant thinking, and the incentive and stamina of the people have been dulled under protective and paternal socialist governments. Three months is a relatively short time to observe peoples and nations that measure their history in terms of centuries and millennia, and your thought about them must be admitted to be casual, abrupt, and uncertain. However, my report to you is a mood, a mood of uneasiness and bitterness and pity and doubt. The general health level in all European countries is relatively low; and, if time would permit, I could furnish you with statistics that are so naked, revealing, bare, and damming by themselves that they generate in me an uncomfortable feeling, for they omit the many fine European men and women who detest materialism and "control" as much as anybody in the world, who are greviously shocked at the statistical figures, but who live in their beautiful countries and literally watch their countries change.

As your official representative, it was a genuine pleasure to attend the meeting of the European Orthodontic Society held last July at St. Moritz, Switzerland. The main theme of the meeting was concerned with social orthodontics, the problem of orthodontic treatment in the social services of the various European countries. Their members exhibited an intense seriousness of purpose, their papers and clinics were the equal of any presented at American meetings, and I was impressed by the fact that European orthodontists are so vitally concerned with problems related to the prevention of malocclusion. After returning to America I checked over a generous portion of our orthodontic literature for several years back, and I was quite surprised to find that the major portion of our recorded papers were concerned with the treatment of malocclusion. One of my good friends from The Hague, Holland, made a statement that startled me very much and it precipitated a friendly discussion that lasted until a very late hour. He stated: "American orthodontists are treating neglected cases, neglected in so far as they delay orthodontic treatment until an age when they cannot do the greatest amount of good for the patient." Many of our European

colleagues continue to believe that inherent growth patterns may be altered by commencing very early treatment. On that score they are twenty years behind in their concept, and some of the excellent cephalometric evidence coming out of Sweden, Norway, and Denmark will, in time, change that concept of wishful thinking. Methods or concepts applied in the interception, prevention, and early treatment of malocclusion cannot be standardized, each case being an individual entity. I heard something about the forward propulsion of the lower jaw by the use of the monobloc in Class II cases, and many over there continue to believe that areas beyond the teeth and the immediate alveolar processes are affected by orthodontic appliances. We know that early treatment is indicated in selected cases, and there probably are cases in which treatment may guide alveolar growth.

Contrary to some statements that I have heard, I found that the European orthodontic standards and ideals are not different from those in this part of the world. Ideal results are being obtained by simple methods, not primarily because their methods are entirely mandatory, but because they are thinking in terms of tissue tolerance and disturbance. It might be well for us to take a far greater interest in their methods of mechanical therapy, simple methods of manipulating living tissues that react, not according to the laws of physics alone, but to the laws of physiology, biology, chemistry, and inheritance as well. There is some danger that we might get lost in minutiae, in mechanics, and in the trivial. I do not think we will, but that could happen.

Many of our European contemporaries, Oppenheim, Friel, Simon, Korkhaus, Bjork, Lundstrom, and many others, have made contributions to the advancement of orthodontics. It is most pleasing and encouraging to note that the recent war has not dimmed the courage of the people in our specialty who practice in the European countries.

Fortunately, we live in a system which has given us more social benefits than Europe even dreams about. The relatively rapid progress in American dentistry as a profession has been primarily due to the foresight, indomitable courage, and forthright thinking of our grand pioneers and scientific dental educators such as G. V. Black, Chapin A. Harris, and many others. The advancement of dental science, techniques, and education has been facilitated by the fact that American dentistry and those associated with dental education desire to maintain autonomy in dental education. Two systems of dental education prevail in foreign countries, the autonomous and the stomatologic. With a few exceptions, I believe that European dental education has been retarded and is inferior in quality because of lack of unity in methods of education. There has been too much domination by the medical profession. In some countries the two systems coexist alongside each other, and there is continuous friction and discrimination between graduates of these schools. A number of these European schools are not incorporated in with or associated with universities. An attempt is being made to establish graduate school education for qualified dentists who are interested in specializing in one of the various specialties. I was very favorably impressed with the dental school in Stockholm, Sweden, and was pleased to note that they are commencing to do a considerable amount of work in cephalometrics.

The meeting was conducted under the competent and able direction of Dr. R. Hotz, Professor of Orthodontics at the University of Zürich. The following statements or excerpts from Dr. Hotz's paper, "Aims and Limits of Orthodontic Treatment in Social Service," are eminently significant, provocative, stimulating, and worth while.

"Our state institutions are now going through a period of revolutionary development, accelerated by two world wars, and brought to everybody's attention by modern media of distribution, by press, telephone, wireless. Every layman hears and knows of the latest successes in technics, medicine, etc., and would like to have his share of them. The social structure of the people is changing, distinctions are vanishing, a leveling-out tendency is everywhere triumphant. The state, once a necessary evil, is becoming a social benevolent society, from which everyone wants to gain something. All classes wish to profit by the progress in medicine and dentistry. This is the spirit of 'National Health' everywhere prevalent, either in the form of obligatory government insurance, or of the private, semi-private, or state-controlled Sick Benefit Societies such as are found particularly in Germany, but also here in Switzerland, and finally even in the form of full-time, officially-employed doctors and dentists. It will not be long before orthodontic treatment will be recognized as a national task. Even today there are countries where the Sick Benefit Societies take over such treatment. However, together with this inclusion under socialized dentistry come *regulations, generalizations, disregard* of *individual responsibility* and *personal ability.*

"Can we imagine at all what is in store for us, what direction this development will take? Will it grow and ripen slowly and organically, or will it arise like a hurricane, neglecting the possibilities at disposal, and thus ending in failure, we may safely say, in *catastrophe?* Will it be possible to influence this development, to slow it down, or at least to guide it into certain channels? Or must we look on helplessly while our aims and ideals are simply being cast aside?

"There is no doubt that this is what may happen. We have seen it happening in medicine and dentistry with the Sick Benefit Societies in Germany; we see the same, though to a less degree, in Switzerland and other countries, we see it today in the crassest form in England, and, as we learn from the newspapers, for the U. S. A. recently proposed the introduction of general health insurance also. Shall all this cause us to sit with our hands folded, and let things come as they will? I am not of this opinion. There is still time for us to *take the initiative in our own sphere.* It would not be a question of being led, but of taking over the leadership.

"A small number of specialists and general practitioners trained in orthodontics treat a certain number of cases more or less successfully. All of them have so much to do that they have already reached the limits of their capacity, where conscientious work ceases and *work in the mass, with all its dangers,* begins. In addition, a large number of children are treated by general practitioners, who have never been trained in orthodontics or whose training is insufficient. And finally comes the largest number of children, who are given no orthodontic treatment, whatever.

"If it is impossible for specialists to take over the orthodontic treatment of all these children, then there is no other way, save for the general practitioner to take part of such treatment in hand, in addition to his already heavy burden. But this he can only do *if he is given simple instructions* for this part of his activity, and if this activity pursues solely limited aims. Our demands should therefore be:

1. *Limitation of the aims of treatment.*
2. *Elaboration of simple methods* that can be followed by the practitioner with chances of success, and with the expenditure of little time, material, and work.

"It is at present the most important task for us orthodontists to study both these problems, and to work out practicable principles of a general nature, as to how the best results may be obtained with limited means. It is my firm opinion that this is the finest and most thankful task, far more gratifying than achieving increasingly better results for a limited number of cases, with increasingly more elaborate means. This competition, known to all of us from the literature and our own observations during the last decades, is no longer so essential under present conditions, and can indeed be carried further within the limits of every private practice.

"At this point I should like to counter a criticism that will undoubtedly be made, and not without a certain justification. It is that such 'deterioration' in treatment is not according to social principles, and represents nothing but a lame compromise. It would be better, so it is argued, to treat only 10% of the cases, but these strictly according to rule. This point of view corresponds more or less to the present situation. But if social measures lead to increased demand for orthodontic treatment, then the 90% remaining, or at least part of it, will be treated by non-specialists, which in the long run would *cause enormous damage to our special branch,* quite apart from the fact that this point of view would be considered unsocial.

"Limitation of the aims of treatment, or better, limitations of indications for treatment, is at the moment the most important and urgent problem. This limitation must be established before the question of orthodontic treatment being introduced in the social program becomes acute. We must be ready for such an eventuality with concrete suggestions. The possibility of carrying out the socialization of medicine successfully depends solely on such a limitation.

"Orthodontics within the sphere of social dental care cannot lead an existence of its own, but can do useful work only by paying consideration to all the other branches of dentistry. Attention must be paid to the problems of combating caries, dental focal infection, paradentosis. Only thus is it socially 'supportable.' Actually it should develop into 'children's dentistry,' and thus become the basis for a positive social structure. In Switzerland, there are fixed regulations for the introduction of obligatory school dentistry. In the first year only the first, lowest class is included, the work being continued here during the next year, and the lowest class again being included. This goes on until after eight years all classes of the government schools are included. Only by

means of this limitation is it possible to obtain financially supportable and dentally favorable results. This procedure would also be applied to the wider sphere of social dentistry for the whole population. After the treatment of schoolchildren comes the treatment of those who have just left school, and only after all these latter have been treated can the next step be taken, and dentistry for adults be included. On this basis only, successful development is possible. If the dentist trained in orthodontics is able to plan his treatment for children far in advance, to pay regard to other branches of dentistry and their demands, then we have advanced far in our efforts to build up a really effective system of dentistry, including many classes of the population."

There you have the cold facts, the state is everywhere triumphant, a benevolent society from which everyone wants to gain something, work in the mass mediocrity, shortage of dentists and great expense, limitation of aims in treatment, regimentation and throttling of ambition, and the handout way to dictatorship by the ruling political class.

Professor Hotz is a brilliant scholar, a capable dynamic person with a background of experience. He radiates confidence and, more than that, the professor is one of the most practical orthodontic leaders in Europe. Hotz is a rugged individualist, and the creeping paralysis of socialism is most distasteful to him and all other European professional men. His paper is portentous, and my reason for incorporating a few paragraphs in my report to you is to provide a shock and alarm that will arouse you and me, our membership, to intelligent action after carefully reviewing the problem. "It is later than you think."

The pattern of "statism" with all its attendant evils is before us, and a leveling-out tendency reduces the whole population to the level of the poorest group. Who gains in a benevolent society from which everyone wants to gain something? The program reduces the people to a state of servitude where there is a disregard for individual responsibility and personal ability. It is only good for those who run and manage the state, and the scheme reduces you and me to the level of serfdom where we are directed by a class or group of politicians. Efficiency and good, honest government go down the drain.

A few additional excerpts from a paper, "Buts et limites de l'orthodontie sociale en France" by M. Beauregardt of Paris, France, will serve to warn that socialism is impossible under any conditions.

"For the last few years French orthodontists have been disturbed by government measures, aiming at modification of their free profession. In the course of the recent congresses of S. F. O. D. F. and F. D. J. violent criticism was expressed. Indeed these scientific societies could not remain inactive and our President, Prof. Hotz, was well advised to suggest this subject as a topic for the E. O. S. meeting.

"Now that governments are devoting so much attention to public health, it is more than time to draw their attention to the danger of their measures, which increasingly encroach upon professional prerogatives and responsibilities that safeguard the standard of medical work without which the humanitary aims of every government would go amiss.

"In France, it is the dental profession itself which has instigated the institution of public dental hygiene by the authorities. Unfortunately this has taken the wrong path. The transformation of the 'Assurances sociales' which were instituted for the economically weak, into the 'Sécurité sociale' including all salaries, what ever the amount of income other than salary, indicates the direction of this interference.

"This has resulted in a certain professional cleavage between official and free practitioners, in mediocrity of treatments given in series and a certain feeling of suspicion on the part of the public with regard to the practitioners performing the most perfected treatments.

"We fully understand the difficulties of the government in this matter, but provisional agreements and compromises must be succeeded by frank and positive conceptions of organization, of responsibilities and professional tendencies.

"In a word, these conceptions conform to our most recent findings, based on the *'Doctrin of Dento-facial Orthopedics,'* the *'Evolution of Social Organization—France,'* its *'Present Organization,'* and the *'Opinion of Well-Known Orthodontists.'*

"Controlling Officials.—Since it is known that the morality, competence and good will of teachers and practitioners in leading positions in the 'Syndicats' are in no way inferior to the qualities of the officials in charge of treatment and control, it would be more suited to the dignity of the free professions if this controlling work should be done by highly qualified practitioners, appointed by the government and accepted by the profession. These functions would be supplementary to the social services given by the practitioners.

"The Standard of Treatment.—In analogy it may be said that the orthodontic measures, limited to prevention and early treatment, would be more correctly performed in the Social Centres of the State, than by the practitioners, both submitted to control. This is an unworthy allegation for the free practitioners and no consideration is given to the fact that the great public institutions also have a very limited activity. Controlling officials have a very delicate task to perform, demanding for OD. F. O. considerable clinical and administrative competence, and the acting dentists no less."

Dr. Beauregardt's paper indicates the gradual transformation from the "Assurances sociales" for the economically weak into the "Sécurité sociale" that includes the entire population. I visited clinics in other countries and particularly noted the lack of patient-dentist relationship, and in some cases the social worker, a member of the party in power, directed the activities of the various clinics. In short, if it can be made to work at all it must be under an all-powerful State with the vast powers necessary to enforce it by decrees governing every sector of our lives.

Professor Hotz and his associates displayed a series of results obtained in the orthodontic clinic located at Zürich, Switzerland. Most of the treatment had been accomplished by the application of fixed and removable appliances such as the oral screen, monobloc, Schwarz plate, and various appliances similar

to the Anderson appliance. Being results that were obtained in a socialized clinic, most of them were a compromise; however, they were a compromise that was well worth the effort under the conditions that the service was rendered. I cannot condone compromise results, as such, and Professor Hotz and others adequately point out that, "Beyond doubt the least adequate part of our service is that given in free or socialized clinics because of the great number to be serviced."

Moving around from one country to another, visiting clinics, talking with dentists and, more important, getting the facts from the citizen who pays the bill in taxes gave me a chance to assess, evaluate, and observe. The European taxpayer is sick of the whole business, and the intolerable burden of paying for all these wild schemes is depressing. Opportunity is all but gone. An excerpt from a booklet, *Social Work in Oslo, Norway,* indicates that: "When we consider the fact that Oslo has 275,000 inhabitiants, one realizes how the City's open eye watches over the citizens from the cradle to the grave. This slogan is not an empty phrase and Oslo has, at its own initiative, undertaken measures of a radical nature." Seventy-five per cent of the people in Oslo make a salary of 4,000 K. or less a year. My experiences over there have convinced me that the goal of the current philosophy of the welfare state, "security from the cradle to the grave," whether you work or not, is unobtainable and unscientific. It seems that the best cure is for people to get back to work.

It is almost four years since we emerged from the most devastating war of all times. The cessation of hostilities is hardly behind us and we continue to carry on a "cold war" that in time will bankrupt us financially. I wish that by some miraculous process I could take you to ruined and devastated cities, yes, to London, with me, to have you see right before you the vicious destruction which war can bring. As I stood near St. Paul's Cathedral and looked at blocks and blocks that were leveled, I was reminded of a line of the Roman historian Livy, where, in talking about the ancient Punic wars, he said, "One day gave to destruction the work of 700 years." If it was true then, what about the destruction that modern warfare brings.

We have hardly passed through that experience and we are already anxious about the next war. Will we have it, or will we not? There isn't anyone in this room today who does not hope fervently that we can, and must if we possibly can, avoid such an experience. Any American of my generation must feel a sort of proprietary interest in Europe. We fought two wars to save Europe. We have been taxed all our lives to help the European countries. If our politicians are not restrained we may have to fight another war. God forbid!

As I went about crossing national boundaries I wondered how anyone who ever traveled in Europe could accept the theory of a world state or have any hope for a "One World" union. Great masses of people who live only a few miles apart can speak no part of their neighbor's language, and have no interest in hearing it. They refuse to accept or exchange each other's money. They cannot trade on each other's goods.

They cross a border line and one squad of soldiers checks them out while another checks them in. I suppose no other form of officiousness is quite so irritating to an American as this snooping by customs officials. And it was nothing to pass scrutiny by four sets of armed guards in one day.

These nations of Europe stand at arms length with one hand on their pocketbook and the other on a knife while their eyes are seeking for a quick getaway. The English are jealous of the French. The French live in constant fear of Germany—broken, destitute Germany. The little countries pray that they may be let alone, and they are all scared to death of Russia, whose visibility to them is unobscured by any "iron curtain" nonsense.

I have learned so many things—seen life as it was lived a century ago on one day and observed the styles that the women of America will wear next year or the next day. Yes, I have seen the futility and inevitability of war and the certain failure of world conquest. More than that it has been my opportunity really to observe the hopelessness and shapelessness of a planned society. And I have gained a new appreciation and pride in American citizenship.

We can draw some vital lessons from what is occurring today in Europe, and I predict that when the American people are taxed to the point where initiative and incentive are destroyed, we will kill a system which has given us more social benefits than Europe even dreams about. But the one thing I cannot understand—and I hope somebody will tell me—is why should the United States ever under any circumstances consider for one moment the designing of its political, social, and economic life on the European pattern.

The obvious course is for the American professions to band together and hold what we have and then seek to extend its benefits to still greater numbers, rather than to destroy the fine service now rendered the immense majority of our people and reduce the whole population to the level of the poorest group. We now know from Britain's costly experiment in socialized medicine and dentistry, yes an experiment paid for in American dollars, that such a scheme would ruin what we have and reduce the whole nation to the level of services now provided in free clinics. The principal victims of all socialized schemes are the taxpayers. Ask every European taxpayer, excluding the politician, and he will give you the same story. To put it bluntly anything compulsory dulls the wits of any individual. Compulsory health insurance under bureaucratic control is very very expensive. Would that we could develop a program of voluntary health insurance entirely divorced from federal control.

The basic struggle is one about the nature of man. Is he supremely important, or is he quite unimportant, only to be used as a tool of the state? It is hardly necessary for me to point out to you that we are going through the agonies of momentous social changes, that there is no one in this group here assembled who knows what the world is going to look like twenty-five years hence, and that there is, all in all, a life-and-death struggle going on in society between the kind of things you and I believe in and the kind of things that some other people believe in. And which is going to come out on top will depend, in large part, upon what you and I, as American citizens, believe and do. "We have a republic if we can keep it."

We cannot be equipped to comprehend the problems we will be called upon to face in the near future unless we gather in unity with our European contemporaries. In closing, I would like to suggest that the members of our association consider the possibility of arranging a joint meeting with the European Orthodontic Society to be held in Europe not later than 1953. Due to the monetary situation and other complications, it will be impossible for our European colleagues to attend an International Orthodontic Congress in our country for at least several years. A joint meeting would be a grand occasion, and many of my friends over there have expressed great enthusiasm for such a project. A cooperative meeting would give everyone an opportunity to renew old friendships and exchange concepts and ideas, and thereby establish a better understanding. If we really get down to business and in a cooperative spirit review our fundamental orthodontic problems, I sincerely believe that orthodontic progress would be stimulated by arranging a joint meeting. There is a vast fund of information that we can learn from our European colleagues, and a large portion of our membership can well afford to attend a European meeting. It is hoped that our officers will make an effort to arrange a joint meeting in the very near future.

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THE PERIODONTAL RESPONSE TO VARIOUS TOOTH MOVEMENTS

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THROUGH the years of practice each orthodontist evolves a plan of treatment which satisfies his requirements for the many types of malocclusions. When he is asked how he treats certain clinical conditions he will invariably reply in terms of the appliance he uses. This is natural since most tooth movements are brought about by mechanical means. We have become split into "Angle Schools," "Johnson Twin Wire Groups," and "Labiolingual Men," and we constantly search for new and different mechanical aids to our clinical practice. Despite the several basic appliances and the hundreds of variations, we still strive for more effective ways of carrying out the tooth movements essential for clinically satisfactory results. Too often our search is for a novel spring, a twist or bend of wire, a new pair of pliers. Though the perfect orthodontic mechanism has not yet been devised, is it not time to carry part of our search elsewhere?

All tooth movements can be described as being (1) tipping, (2) intrusions, (3) extrusions, (4) bodily movements, (5) rotational movements, or (6) combinations of these (Fig. 1). While we speak loosely of what one appliance will do and what another is unable to achieve, we would be more correct to speak of what the periodontal membrane will allow one appliance to do and what it denies another. Whether we use a round wire, square wire, edgewise wire, or ribbon wire does not matter; it is the periodontal membrane which actually is going to effect movement. Whether we use one wire, two wires, or fifteen wires, as one of our Australian colleagues has advocated,[1] all tooth movements are brought about by the same physiologic response. How does the periodontal response vary during these different tooth movements? What is the periodontal reaction to the several standard appliances? Are some of our clinical limitations to be found in a study of this tissue? This paper proposes to discuss the periodontal response to the various tooth movements and some of the clinical implications of that process.

The maintenance of the integral physiology of the periodontal membrane is, perhaps, the most important single step in any orthodontic therapeutic procedure. The principal fibers of the periodontal membrane cradle the roots of the teeth in such a way that a small but important amount of movement is allowed each time the teeth occlude, for this membrane is the tooth's natural shock absorber. A more important function for the orthodontist is carried out by this tissue when structural changes in the osseous alveolus are brought about. The

Read before the American Association of Orthodontists, Chicago, Ill., May 11, 1950.

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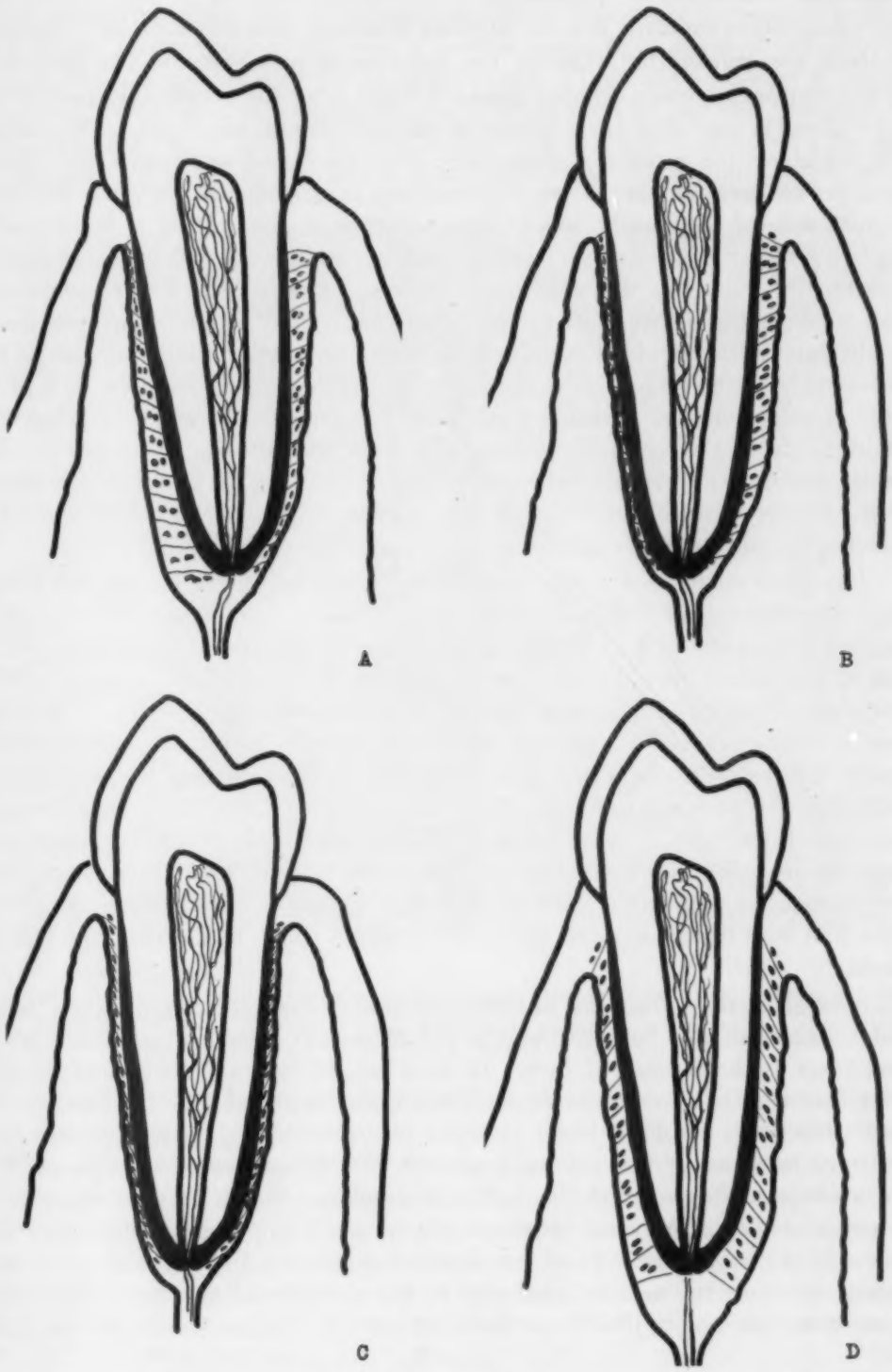


Fig. 1.—Diagrammatic representation of various tooth movements. *A*, Tipping; *B*, bodily movement; *C*, intrusion; *D*, extrusion.

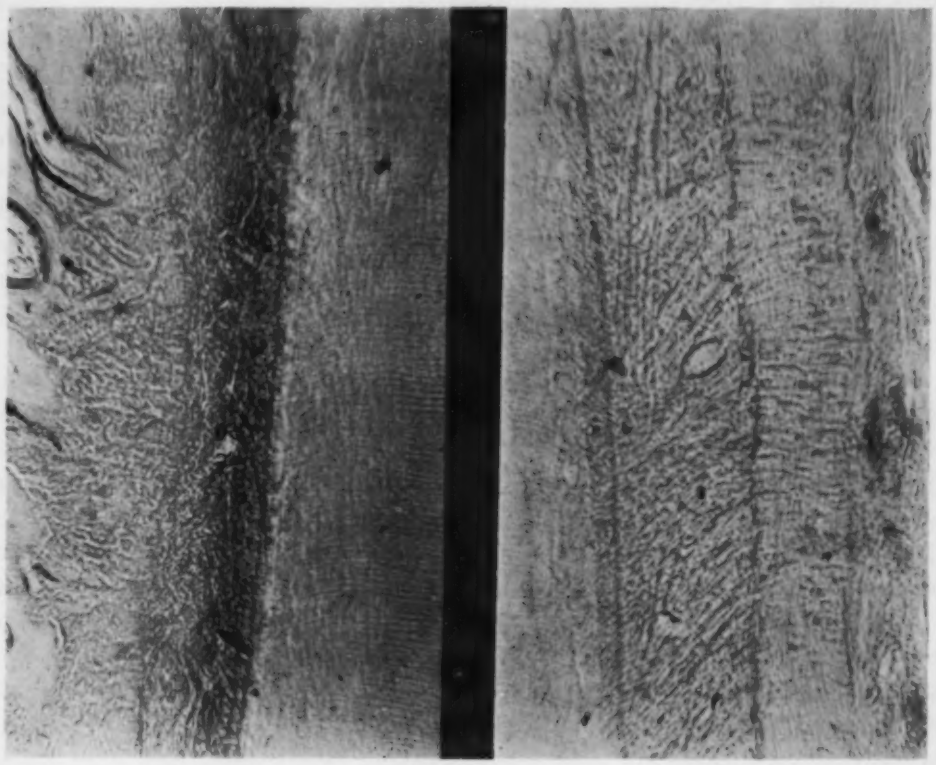
periodontal membrane is involved in these bone alterations in two ways: (1) periodontal fibers continue into the alveolar bone and thus forces brought against the tooth are transmitted through the periodontal membrane to the alveolus; (2) the transient osseous cellular elements which alter the trabecular framework of the alveolus may find their origin in the periodontal membrane. We know little yet about the genesis of these cells; they are called osteoblasts and osteoclasts, yet on occasion they arise in abundance in periodontal regions. Nor are we quite sure of the specific role of each cell type in this matter of bone reconstruction. What is known is that they both are essential and have their origin in connective tissue, in this case the periodontal membrane. The sustentation at all times of the integrity of the periodontal capillary bed is important, since an adequate nutrient blood supply is required to mobilize the osteoclasts and osteoblasts. The periodontal capillary bed is fed from three sources: (1) periapical vessels from the medullary spaces of the bone; (2) vessels entering the membrane from the gingival mucosa and from the alveolar periosteum; (3) vessels entering the periodontal membrane from the alveolar wall of the tooth socket. There is an elaborate collateral circulation within the membrane and this anastomosing accounts for the uniform size of the vessel lumina.

Any force on the crown of the tooth is transmitted to the periodontal membrane immediately, and through its fibers to the supporting bone (Fig. 2). Histologically these forces exhibit the classic pressure and tension areas on opposite sides of the tooth's root. If the force is sufficient, it may alter the shape of the periodontal vessels or the rate of flow of the blood contained therein. When the force is active over a long enough time, necrosis, due to failure of nutritional supply, is the result. Bone changes cannot then take place until the periodontal membrane has first regenerated. Thus, it can be seen how the resorptive and depository procedures in bone, necessary for all tooth movements, are dependent upon the periodontal blood supply. The truth is that very little continuous force is required to bring about stasis in the periodontal vessels, which condition is the first step in the series of pathologic changes which make tooth movements possible.

Several factors affect the initiation of this process of change in the periodontal membrane and bone incident to the placement of an activated appliance. First there is the amount of force, its sheer weight in grams or ounces; second is the distance the force is active; and third, the length of time the force is applied. Since the capillary blood pressure is approximately 25 Gm./square cm., any force in excess of this amount is certain to diminish periodontal blood flow. The average thickness of the periodontal membrane in the human being is in the neighborhood of 0.2 mm.; therefore, forces active over a greater distance will interrupt the blood flow. Time, too, is a factor, since a light force may, if continued, overcome the natural resiliency of the periodontal membrane and bring transformations not unlike those demonstrated by heavier forces of less duration.

During the tipping of a tooth, the blood supply to the periodontal membrane is obstructed in two areas (Fig. 1,*A*). One of these is caused by the movement

of the apex of the root and appears as a region of compression just above the root end. The other area of pressure is found diagonally across the tooth in the region where the moving root is pushed against the crest of the alveolus. The only protection against permanent damage to these viable tissues is the rich anastomotic character of the membrane. Unless the very lightest pressures are used, the membrane, during tipping movements, is crushed just above the apex of the root on one side and at the gingival crest of the alveolus on the other.



A. *B.*

Fig. 2.—Immediate response of the periodontal membrane to orthodontic forces (edgewise mechanism exerting 150 Gm. for thirty minutes). *A*, The pressure side; *B*, the tension side at the same level. Note the absence of large numbers of transient osseous cellular elements and the normal appearance of bone. (From Moyers, Robert E.: J. Am. Dent. A. **40**: 22-27, 1950.)

The necrosis thus induced is rather localized, the debris is easily carried away, and regeneration of the tissue is begun almost at once. It is fortunate that most of the orthodontic movements are tipping procedures, for the recovery of the membrane is faster and the chances of permanent injury are less in this movement than in most others. One of the problems inherent within this type of movement is that the periodontal response to the controlled tipping of a tooth is much different than the reaction to an uncontrolled, "seesawing," "jiggling," "back-and-forth" type of tipping movement. The initial tissue response is identical; the final reaction is very different.

Bodily movement, by definition, is the simultaneous progression of the crown and apex of the root in the same direction. When this action is attempted

a far different periodontal reaction can be expected. During true bodily movements, and few appliances can actually effect these, all three sources of blood supply to the periodontal membrane are cut off on the side of pressure and a diminishing of the rate of flow in the periodontal vessels on the tension side of the tooth as well is seen (Fig. 1,*B*). This can mean only one thing; the establishment of collateral circulation and the regeneration of the membrane tissue take place much more slowly. The latent clinical response to bodily movements occurs because a larger area of regeneration must be undertaken and less nutrient blood supply is available to carry out the task. The orthodontic literature is full of phrases such as "starting the tooth movements," "limbering up the tissues," "getting the teeth used to the appliance," and "waiting for the teeth to move." These refer to that period during which the periodontal membrane is necrotizing and regenerating and the transient osseous cellular elements are making their appearance in sufficient numbers to begin bone changes. Bodily movements of teeth are more likely to cause real damage to the supporting tissues than tipping, and furthermore they are more difficult to bring about clinically. Unfortunately, the only appliances which have demonstrated true bodily movement in histologic sections are also those which are most difficult to adjust in the lighter range of forces. Frequently bodily movement of a tooth is desired clinically, and it is possible to do this mechanically, but the physiologic reaction is so severe that the utmost care and caution are indicated at all times.

Many orthodontists find their greatest clinical challenge in the intrusion of teeth. The problem again is one of periodontal nutrition. The conical shape of the bony alveolar socket is such that intrusive forces against the tooth most effectively cut off the very blood supply that makes tooth movements possible (Fig. 1.*C*). A slight force directed parallel to the long axis of the tooth will compress the entire periodontal membrane against the enclosing bone. Almost total membrane regeneration must take place, and with greatly diminished blood flow if osseous changes are to occur. More than in any other movement, continuously applied forces are to be avoided during intrusions.

As could be expected, the reverse situation prevails when teeth are being extruded (Fig. 1,*D*). So long as a very light force is applied, the essential periodontal changes will appear quickly and bone transformations will occur readily. Increasing the force often causes such a stretching of the fibers that periodontal blood flow is once more impeded. Nor should it be forgotten that the extrusion of teeth in occlusion is contraindicated for the same reasons that the "jiggling" type of tipping movements are to be avoided.

Histologic sections of teeth which have been rotated about their long axis show the regular areas of pressure and tension, the number and location being dependent upon the cross-sectional shape of the root.[3] Large masses of the membrane undergo necrosis and regeneration due to these compression regions, but the chief interference to periodontal blood flow is the periodontal fibers themselves. As they become twisted upon one another during rotations they diminish the lumina of the capillaries sufficiently to cause resultant slow osseous transformations. This accounts for the failure of rotations to occur clinically with the speed seen in tipping.

No matter which of the various movements are attempted, the speed of clinical response is determined by the amount of periodontal membrane which must be regenerated before the osseous changes occur. Histologic studies do not confirm the use of the phrase "physiologic tooth movement" when referring to modern orthodontic appliances. Regardless of how the movement might be classified, the periodontal membrane knows nothing of number or shape of arch wires; it simply reacts biologically to weight of force application, distance of force application, and duration of time the force is active.

Round wire mechanics are used clinically in labial arch wires, finger springs, and in the lingual arch wires. Great differentiation should be made between the mere pressing of a loose, dangling finger spring against the tooth and the controlled close bracket engagement of a precision-fitted round labial arch wire. Both result only in tipping, but the latter by its support reduces the damaging action introduced by cusp interference and occlusion, because it sustains and protects the periodontal membrane against the constant insult of to and fro "jiggling" action. A gentle controlled tipping action against the tooth will elicit a hasty periodontal recovery and an equally speedy osseous response. (Fig. 3.) The constant pounding back and forth of uncontrolled forces, even though they be tipping actions, can only seriously jeopardize the integrity of the periodontal membrane. If a tooth is to be tipped into a position where it will suffer, even if temporarily, unusual stresses, the use of a controlled type of movement is highly advocated. The addition of spurs or vertical pins to the round wire, of course, does away with the simple tipping type of force application and calls into action the periodontal response typically seen in bodily movements. Round wire appliances can effect tipping movements easily provided the ordinary rules of light force application over a short distance are observed. Histologic sections do not bear out the claim that the light application of round wire mechanics will result in bodily movement of teeth.

The edgewise wire, square wires, and other rigid rectangular wires that are used in accurately machined brackets give rise to a similar periodontal response. It is possible with the edgewise mechanism to demonstrate actual true bodily movement of teeth in the histologic sections. But it is also true that measurements of the forces inherent within this appliance as it is ordinarily used are completely beyond the limits of periodontal tolerance physiologically. When the edgewise mechanism is used the osseous response appears quite some time after it might if a lighter action were used. This is the reason that advocates of this appliance invariably begin their therapy with a very light round labial arch wire. The periodontal response justifies that procedure. But this still does not prevent the subsequent insult and trauma to the membrane once the stiff rectangular arch wire is applied. It is true that certain movements can be carried out more efficaciously with this appliance than many others in common usage, at least the histologic findings would so indicate, but it is also true that it requires the utmost care and caution to avoid making a hemorrhagic mass of the membrane. Experimental data show that root resorptions are caused more easily with this appliance and the pin and tube appliance than any others

B.

A.

Fig. 3.—Photomicrograph of tipping movement (twin wire mechanism, initial force, 80 Gm., duration of force, twenty-eight days). *A*, The compression area at the gingival crest of the alveolus; *B*, the compression area at the apex of the root. A similar picture is seen with round labial arch wires or other tipping mechanisms. (From Moyers, Robert E.: J. Am. Dent. A. **40**: 22-27, 1940.)

tested. From a practical standpoint these studies seem to indicate that all of the movements possible should be carried out with the light round arch wire first. The avoidance of an early insertion of the edgewise mechanism will minimize periodontal trauma. It should also be noted that it was only with extreme difficulty that pure bodily movements were demonstrated with this appliance; the result almost invariably is a combination of tipping and bodily movement. Intrusions are done with difficulty. Experimentally, at least, the result was more often the extrusion of other teeth rather than the intrusion of the desired teeth.

Fig. 4.—Odontoclastic action induced by tipping movements (twin wire mechanism, initial force, 65 Gm., duration of force, eighteen days). This root resorption took place just above the apex on the pressure side.

Of the appliances tested, the twin arch was easier to apply in the desired range of force application. But do not be deceived by the apparent light, delicate action of this appliance. It is too often allowed to act over a dangerously long expanse with the resultant effect of damage not unlike that seen with mightier appliances over short distances (Fig. 4). We found less trauma and

earlier response to tipping movements with this appliance than with most others. We were unable to demonstrate bodily action with the twin wire mechanism. This was true even when the principal action was from a coil spring on the twin wire section. It was found that intrusions of anterior teeth could be effected with this appliance, but sections of the molar teeth showed they had also extruded in a tipping fashion. For obvious mechanical reasons the twin wire mechanism is not satisfactory where the actual bodily movement of premolars is desired. Apparently the greatest danger in this appliance is the tendency to allow the twin section to be active over too great a distance. Many men use this appliance because of its light action; they should also make sure that the action has a short effective distance as well. Distance and time can damage the periodontal membrane as much as sheer weight.

Flat wire mechanics are seen in the universal appliance and on occasion in the place of twin arches in the Johnson mechanism. The periodontal picture with this type of force application is strange in that it forces the fulcrum of rotation nearer the apex of the root, so that the movements approach those of true bodily movement. In all the sections studied there was some indication of jiggling and rocking of the tooth in the socket. The recovery from this type of mechanism is rather speedy and movements progress readily if the arch wire has not been adapted to be active over too great a distance.

Ideally an appliance should operate over a distance of less than 0.2 mm. with a force of between 15 and 25 Gm. Further, it is desirable to have this an intermittent weight against the tooth in order that the periodontal membrane may enjoy periods of recovery. Such an appliance does not yet exist. Until its development it behooves us to study the limitations of our present mechanisms. There are real physiologic reasons for the popularity of those in common usage. Likewise, there are physiologic limitations in each of them. If this were not true we would all be using the very same appliance.

That we often fail in our therapeutic procedures is the admission of most orthodontists. Perhaps some of our failures are due to our mechanical inabilities; more, it would seem, can be attributed to our lack of understanding of the significant role played by the periodontal membrane in tooth movements. Without its physiologic and pathologic response the specialty of orthodontics would not exist. As we strive for more effective and efficient appliances, let us search for a mechanism that will enable us to treat this delicate tissue with the respect it demands. Or let us devise new methods of handling present-day mechanisms so that the routine traumatic pathology of this tissue will be avoided.

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FUNDAMENTAL CONCEPTS IN ORTHODONTIC EDUCATION

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DURING the past one hundred years, the field of dental education has gone through a complete transformation. Beginning as a craft it has become something between an art and a science. The craftsman came to realize that regardless of how exquisite his technique might be, it was frequently of no avail when applied to a living being. He found that he must know something about the workings of that being before he could successfully apply his techniques to its treatment. In answer to this demand, the course of training was broadened to include subjects of a biological nature.

Professional education, both clinical and preclinical, has now become the study of a series of specialties, each with its own fund of knowledge, its own techniques, and its own peculiar biases. This intense specialization has led to great advances in the knowledge of each field, but at the same time to an almost complete segregation, one from the other. Such segregation seems invariably to lead to an overstressing of details at the expense of general fundamental principles because each teacher feels that his pupils must know all of the details of his particular field. Thus the primary objective of adding biological supporting courses is frequently lost because the means have become more important than the end. Educators are now coming to realize that the mere accumulation of a mass of facts does not constitute an education. The aims should be the *training of the ability to reason* from facts plus the arousing of an intellectual curiosity and enthusiasm.

For the past fifteen years it has been my privilege as a dental educator to aid students to appreciate the significance of the dental apparatus as a whole and the dynamic fundamental principles upon which it operates. To do this it is necessary to impart the fundamental information as to the normal relationship that exists between the forces produced during function and the manner in which they are resisted.

Teeth should be looked upon as mechanical tools designed to do certain mechanical work. From evidences of organic evolution, we find that many types, forms, and designs were tried by nature for the animal to adapt himself to the environmental conditions.

In studying the evolution of teeth, we find that the first form of tooth was the dermoid scale of the shark, which was attached to a cartilaginous rim by fibrous tissue. These teeth are simple cones, extremely sharp, and used only for grasping. As time went on, there was, we find, increased power in the jaws, with bone replacing cartilage as a medium of support for the teeth. This change was accompanied by a change of tooth attachments, which increased efficiency. At this stage of development attachment was by ankylosis to the bone.

This thesis was submitted to the American Board of Orthodontics in partial fulfillment of the author's requirements for certification.

There followed alterations in the defense mechanism and variations in the digestive tract due to the change from a water to a land habitat. These were reflected in changes in tooth function, crown and root form, and in tooth support. The roots were placed in alveolar sockets in bone and attached thereto by fibrous connective tissue.

We often think of the prime function of teeth as organs of mastication. Actually this was one of the last functions they came to serve. They were functioning as an instrument of prehension, an instrument of combat, sexual warfare, locomotion, and as tools to obtain food before the late Mammalian era, during which period they began to help in the mastication of food.

Let us first study the general principles governing the support of tooth stress. The stress placed upon the crown is transmitted through the root and thence to the bone around it, by way of the periodontal membrane fibers. Here, these forces are either sustained in the substance of the bone, as in the mandible, or transmitted through the bone to other bones as in the maxillae. An examination and study of the simple function and the resistance to the stress as seen in various animal dentures will permit a better analysis of these principles. For such an analysis let us use the incisors of the rodent, whose teeth are the most efficiently functioning teeth of the animal kingdom. They are highly specialized, serving as a tool for the prehension of food and as a weapon. The mandibular incisor of the rodent arises posteriorly to the last molar, runs in an even arc under the molars, and emerges in the anterior portion of the jaw. The maxillary incisor arises anterior to the molar series and forms an arc of a smaller circle as it travels through the jaw, to emerge in front. During function, these teeth have a very definite labial resultant of force upon them, but the labial surfaces of these teeth have a very thin covering of bone and no true periodontal membrane. The lack of bone over this labial area must make us look elsewhere for the support of this labial resultant of force. Further examination of the tooth shows that only the mesial, lingual, and a small part of the distal surfaces are covered by cementum, to which the periodontal membrane is attached. This lack of bone supports the thought that resistance to displacement is offered by the *pull* of the periodontal fibers on the heavy lingual bone. This, I think, is conclusive evidence that the periodontal membrane functions as a suspensory tissue rather than as a cushion. The teeth are therefore not supported by their bases, the maxilla and mandible, by the resistance of the bone to a direct pressure as a foundation supports a building, but rather they are suspended in their alveoli by the fibers of the periodontal membrane. Stresses upon the teeth are transmitted to the cribriform plate of the alveoli by the *pull* of these fibers, not as a mattress-like resistance between the root surface and bone.

Now that we have briefly covered the true physiology of the periodontal membrane, let us turn our attention to a brief discussion of the supporting substance bone.

Each bone of the body has gone through a long evolutionary development involving millions of years. Each has been gradually modified and refined in accordance with functional demands until at present it seems to reflect perfectly

the harmony between form and function. This applies not only to its gross form but also to the type of bone tissue involved, its arrangement, the size and direction of its spicules, and the course of its Haversian system of canals. From all of this we arrive at the Law of Bone Design: "A normal bone represents the least amount of material, most efficiently arranged to carry the peak of the load of its various functions."

Bone, like other tissues of the body, possesses the ability to repair itself. But bone has another property in that it can change to meet new demands that may be put upon it during the life of the individual. One begins with the premise that the least amount of bone is most efficiently arranged to carry the peak of the load of normal function. However, if the load were changed to a new direction, we find the application of Wolff's Law of the Transformation of Bone to hold true. This states, "Every change in the form or function of a bone or of its function alone is followed by changes in its internal architecture and no less definite alterations in its external architecture *in accordance with mathematical laws.*"

The amount of bone is genetically determined; only the arrangement of its constituent elements can be altered. Also the inherited pattern is designed to resist the stresses that the bone has been evolved to resist. This resistance can be increased without damage as long as the increased load is directed along the lines that the bone was phylogenetically designed to withstand. This is known as the adequate stimulus. On the other hand, let a very slight force act upon a bone in a direction which was not phylogenetically designed to withstand and deformity results.

Since most natural functional forces are intermittent, which permits rest periods, it is only reasonable that bone will give away more rapidly to a steady force than to an intermittent one. Bone, however, will respond to any force, but it is found to build *against* stress.

Orthodontics is blessed among the sciences in having a fact upon which to base its reasoning, and that fact is that the tooth once laid down cannot be changed. This fixity of form requires surrounding structures to accommodate themselves to the teeth. Therefore, a study of the significance of tooth form or design is important.

Since our denture reflects a function of both incising or snipping and a milling or mastication of the food, let us briefly turn to the study of a tooth form from animals highly specialized in those functions.

First let us consider the carnassial teeth of the carnivore. These have only the function of snipping the food in small enough pieces for the animal to swallow. The crowns of these teeth are flat buccolingually, with two sharp, high cusps set anteroposteriorly which taper to a knifelike edge. When the maxillary and mandibular teeth are brought together in function, a diamond-shaped opening remains, bounded by four cutting blades. In this opening the food is trapped as between two pairs of shears operating simultaneously. In a pair of shears, there is a traveling point of contact throughout the stroke. Likewise the same principle is observed in the functioning stroke of the carnassial teeth. As these teeth pass each other the stress in the maxillary tooth is toward the buccal surface; and in the mandibular, it is toward the lingual surface.

To support these stresses, there are a mesial and a distal root, both of which are flattened buccolingually, and we find the greatest bone development on the lingual side of the upper and buccal side of the lower. Also, upon close examination of the maxillary root design, we find a cone-shaped root placed at right angles to the occlusal surface which is designed to increase the root surface, and hence the periodontal membrane attachment, against the direction of stress.

Let us next consider the functioning teeth of a herbivorous animal, living on grains and grass which require severe milling or mastication. The functioning area or occlusal surface is composed of enamel, cementum, and dentine. The cementum and dentine, having less density, wear down at a faster rate than the enamel, developing grooves and depressions between the harder enamel ridges.

The stroke of the mandible is in a horizontal direction, traveling across the maxillary teeth from buccal to lingual surface in an archlike pattern. The occlusal surface of the mandibular teeth is lower on the buccal edge, while the occlusal surface of the maxillary teeth has an inclination toward the lingual. Therefore, the resultant stress is in a buccal direction in the maxillae, and in a lingual direction in the mandible.

To support these stresses, we find the mandibular molars having two roots, a mesial and a distal, which are flattened mesiodistally and present many grooves which increase the surface area for periodontal membrane attachment. The maxillary molars have three roots, a mesial, a lingual, and a distal root. The large lingual root is flattened on the buccal and lingual surfaces to increase the attachment of the periodontal membrane against the direction of stress.

Other important observations that a close analysis of the carnivorous denture brings out follow:

1. Function is restricted to two teeth on each side.
2. Delicate cutting edges and the need for their meeting accurately make strict control of the stroke imperative. This control is provided by long canines and a tight temporomandibular joint.
3. A physiological reaction to functional stress causes teeth to move even closer together. This constitutes the adjustment to wear.
4. Function is impossible on more than one side at a time.

In the herbivorous denture we also find the following:

1. The entire load of occlusion is taken on only one tooth at a given instant of time.
2. Occlusion is a wavelike phenomenon starting in the back, moving forward, involving ridge after ridge until centric relation is reached.
3. Occlusal wear is taken up by a persistent eruption of the tooth throughout life.
4. It is impossible for function to occur on more than one side at a time.

As Brodie has pointed out, the main function of the mandible is mastication and the structure of the bone reflects this fact. The maxillae have the added

function of housing the upper end of the respiratory tract and the organs of sight. Thus we find modification in design of the supporting bone to meet these different demands.

In summary, the general principles revealed in the study of animal dentures are as follows:

1. The periodontal membrane acts as a suspensory tissue and not as a cushion.

2. Animal dentures are broken up into segments, two buccal and an anterior, no two of which may operate at any one time.

3. In all animal dentures the force of mastication creates a tension or pull in the bony framework, rather than pressure.

4. The form and arrangement of the roots, the distribution of the fibers of the periodontal membrane, and the organization and distribution of the supporting bone all are designed to withstand the pull created by function. This will be found to be in the area of the *resultant* of the forces and is seldom in the long axis of the tooth.

One may therefore conclude that tooth form has arisen as the result of a multitude of dynamic forces and that this form, in turn with the several functions, contributes to the maximum efficiency of functional forces and of the tissues and organs with which they are associated. With each factor contributing its share to the harmony of the whole, we have a mechanism capable of doing the maximum amount of work with the expenditure of the minimum amount of material and energy.

When attention is turned to the forces produced during function and their manner of resistance in the omnivorous denture, such as found in man, the problem becomes more complicated. In function and support, the tooth of the omnivorous animal presents characteristics of each of the other groups discussed. Human teeth can be divided into three groups according to their function as well as their position in the dental arch: the anterior segment used for shearing, and the right and left buccal segments used in true mastication as a combination of shearing and crushing or milling.

In function the mandible is moved forward until the mandibular incisors meet the maxillary incisors end to end, and the mandibular teeth move up the lingual inclined planes of the maxillary incisors in completing the stroke. They do not function as true shears because their incisive edges remain parallel, rather they resemble the chisel in action.

The buccal segments somewhat resemble those of the herbivores in function. The marginal and transverse ridges have shearing properties and the cusps and grooves possess a milling or crushing property. Thus, these buccal or molar segments constitute the true masticating groups.

In normal function, the human mandible has a limited lateral stroke. In mastication of the right side, the mandible is caused to swing in this direction by a forward movement of the condyle on the left side due to the contraction of the left external pterygoid muscle and a rotation of the right condyle. The right buccal segment functions as the mandible swings back to centric position.

As the marginal ridges of the mandibular teeth pass those of the maxillary, a shearing action is produced. When the stroke is nearing completion, the cusps settle into the pits and grooves of their antagonists with a crushing effect. The buccal segment on the opposite side is out of function until the stroke is almost completed and the mandible has returned to centric position.

An analysis of the direction of the stroke of the mandible gives us a knowledge of the direction of forces acting on any tooth. Thus, the pressure of the mandibular buccal teeth against the inclined ridges of the maxillae results in a buccal force above and a lingual force below. In like manner, the fact that the lower incisors function against the lingual surface of the upper incisors makes it apparent that there is a labial force on the upper incisors and an equal and opposite lingual force on the lower incisors.

Man is the only animal that has a continuous tooth contact throughout the dental arch; all others have two or more diastems. This mutual support is a result of the vegetable diet, and through this continuity of contacts, it constitutes a very important accessory factor which antagonizes the forces acting upon the teeth, and thus contributes to the support and anchorage of those teeth. Such a continuous contact lends to each tooth in function the support of all the teeth in the arch.

I would like to leave the thought with you that an individual tooth has a more important function than that of offering an occlusal or incisal surface for the purpose of mastication. It is an essential key in the dynamic balance of tooth and denture position, which if lost entirely or partially, destroys balance, liberating forces which cause tooth shifting.

After a detailed analysis of the significance of tooth and root design with emphasis on the resultant forces their pattern reflects, it is important to present the role of the posterior restraining forces of the denture, namely, the buccal musculature.

In the study of tooth design and its influence on the drift tendencies of various teeth, it will be shown that there are certain resultants of force, the resistance to which could not be taken care of by other teeth or by the arch principle. Among the most striking of these were forces tending to drive the maxillary incisors labially and the maxillary canines mesiolabially. These two drift tendencies are antagonized by musculature, chiefly the buccinator, mentalis, and other muscles of expression.

It is significant that all of these forces do not cease to be active when the denture has reached maturity, but continue as long as teeth are present. Truly our denture is a dynamic one and a keen appreciation of this fact is essential to our orthodontic education.

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CLASS I NEUTROCLUSION

Report of a Case

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THIS case report is presented not because there is anything unusual in the treatment, but because an analysis of the tooth movements may be of possible interest.

The patient was a boy 11 years old. As can be seen from the models (Fig. 1), this was a Class I neutroclusion case with crowded maxillary and mandibular incisors and with the four cuspids partially blocked out of the arch. The maxillary cuspids had not yet erupted, but it was obvious that there was only about half enough space for them. There was a slight labial inclination of the maxillary central incisors.

As distinguished from the remote or underlying causes which are unknown, the proximate cause, that is, the immediate reason for the existence of this malocclusion, I believe to be a disharmony between the total amount of the tooth material and the size and form of the basal arches which support the tooth material. The basal arches were slightly deficient both laterally and anteroposteriorly, although the lateral deficiency was slight. The boy had 98 mm. of tooth material from the maxillary first molar to the maxillary first molar, which called for an arch about 43 mm. wide across the buccal cusps of the first premolars. The maxillary arch was 35 mm. wide in this region in the original condition, but if it had been possible to move all of the buccal teeth distally to where the basal arch was wider, then there would have been almost sufficient basal arch width to support a dental arch of normal width. The anteroposterior deficiency will be demonstrated later.

Following the extraction of the four first premolars, the mechanical therapy employed in the treatment of this patient was as follows: The first molars and the four maxillary incisors were banded. Removable lingual arches and twin wire labial arches were placed. The mandibular lateral incisors were ligated to the twin wire arch. The mandibular cuspids were moved distally by the wedging action of the lateral incisors as these teeth were moved forward. Slight intermaxillary elastic force was used to retract the maxillary central incisors. After the maxillary cuspids erupted, they were banded and moved distally by means of coil springs on the twin wire section of the arch between the lateral incisor bands and the cuspid bands. Active treatment extended over a period of about twenty months. The mandibular twin wire arch was in place only a short portion of this time.

Observe the positions of the mandibular cuspids, which still slightly overlap the lateral incisors. The reason for this will be pointed out later. The third

Presented before the Northeastern Society of Orthodontists, New York, N. Y., Nov. 29, 1949.

molars are erupting in good positions. The boy was 18 years old when the second models were made.

The orthographic projections of the case before and after treatment are shown in Fig. 2 (before treatment on the left, after treatment on the right).

Fig. 1.—Models before and several years after treatment.

Note the normal relationship of the anterior teeth to the basal arch outlines after treatment and how the buccal teeth fall within the basal arch outlines both before and after treatment. The mandibular basal arch outline lies slightly forward of the maxillary basal arch outline in both the original map and the map of the case after treatment, which is a normal anteroposterior relationship

of the basal arches. By superimposing the maxillary basal arch outline and median raphe of the patient before treatment upon the same lines of the patient after treatment, we are able to demonstrate the tooth movements which actually occurred.

The composite maxillary and mandibular maps showing the tooth movements are seen in Fig. 3. The maxillary central incisors have been retracted, the lateral incisors have been rotated and moved distally, the cuspids have been been moved distally, and the residue spaces created by the extractions of the first premolars have been closed by the mesial movements of the teeth distal to the spaces.

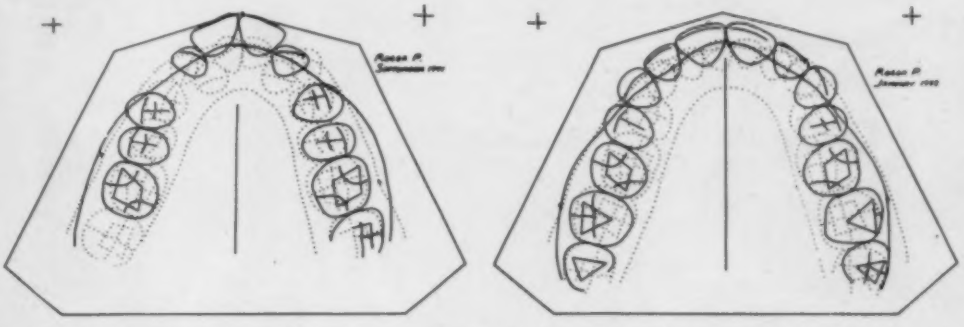

Fig. 2.—Maps of maxillary and mandibular teeth and basal arches. Before treatment on the left and after treatment on the right. Maxillary teeth and basal arch outlines solid. Mandibular teeth and basal arch outlines dotted.

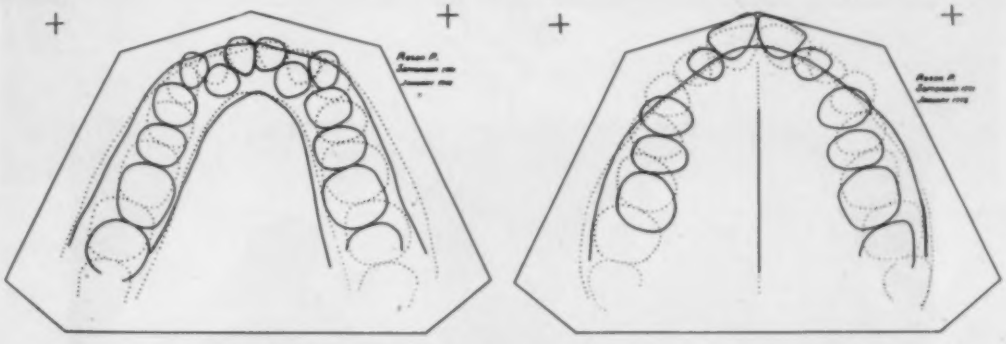

Fig. 3.—Composite maps of case showing tooth movements accomplished. Solid lines before treatment and dotted lines after treatment. Mandibular map on the left; maxillary map on the right.

The mandibular central incisors remained about where they were, the lateral incisors moved forward, the cuspids moved distally, and the residue spaces were closed by the mesial movements of the teeth distal to the spaces. There was fully as much forward movement of the posterior teeth as there was distal movement of the cuspids.

The object of this case report is to present not only an analysis of the tooth movements actually accomplished following the extraction of the four premolars, but also to demonstrate the tooth movements which would have been necessary if no teeth had been extracted. A method of ascertaining these movements through the use of models alone will be described.

Duplicate models were made, and the teeth were cut off as shown in Fig. 4. The original models should record as much of the supporting bone as possible, and care must be exercised in making the saw cuts between the teeth, keeping them perpendicular to the base, and being sure to run them high up into the anatomical portions of the models.

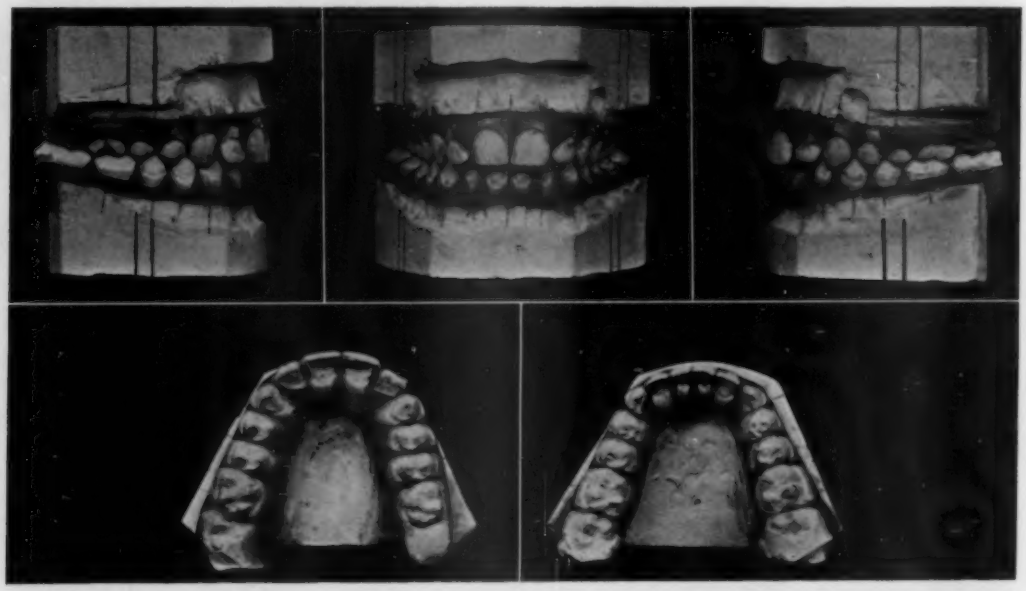

Fig. 4.—Wax setup. Black lines indicate amount maxillary and mandibular first molars would have to be moved distally if full complement of teeth is maintained.

Fig. 5.—Maxillary and mandibular basal arches of original models with saw cuts running down into them, showing mesiodistal positions of various teeth.

When the teeth are set up, the anterior teeth should be placed in proper relationship to their supporting bone, and the arch should be made no wider than the basal arches as shown in Fig. 5. When the setup has been made in this manner, it is possible to see how much expansion and how much distal movement of the buccal teeth will be required. The distal movement is indicated by observing the relationship of the teeth in their new positions to the vertical cuts in the models, which show where the same teeth had been originally. On the carved portion of these models, I have drawn lines above and below the cuts

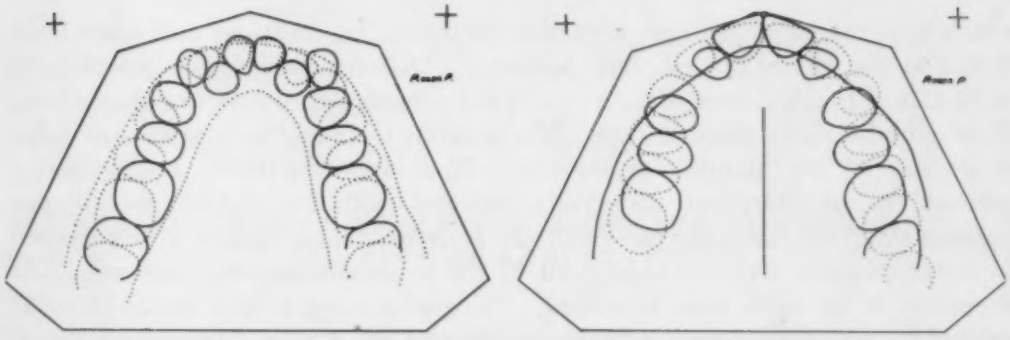

Fig. 6.—Composite maps of original models and setup, showing tooth movements necessary to maintain full complement of teeth.

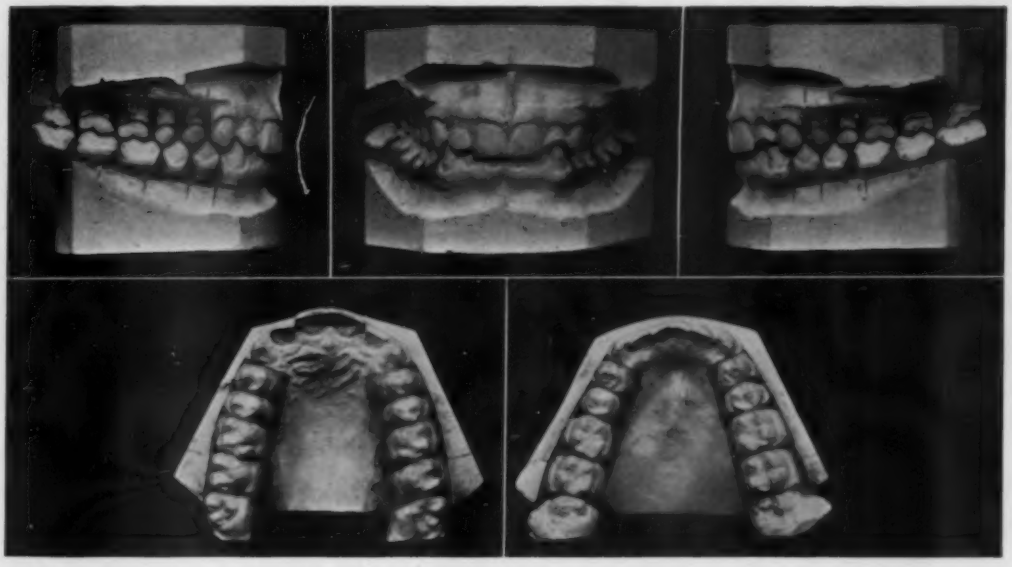

Fig. 7.—Wax setup of posterior teeth made on models of case several years after treatment, leaving relationship of anterior teeth undisturbed.

Fig. 8.—Photograph of boy several years after treatment.

which were mesial to the first molars in their original positions and other lines mesial to the molars in their new positions. The maxillary molars would have to be moved nearly 5 mm. distally, while the mandibular molars would also have to be moved distally about 3.5 mm. The anterior teeth had to be spaced in order to go around the mandibular incisors. These spaces indicate a disharmony between the maxillary and mandibular anterior tooth material, the mandibular incisors being too large for the maxillary incisors. These models were surveyed in order to point out graphically all of the tooth movements which would be necessary if no teeth were extracted. Composite maps of this setup (Fig. 6) related to the original map indicate the same movements in a little more detail.

All of the buccal teeth, both maxillary and mandibular (practically the entire denture) would have to be moved distally several millimeters. The maxillary teeth would require the greater movement, because in the original condition they were forward of their normal relations with their mandibular antagonists.

Fig. 7 presents another setup, preserving a full complement of teeth, but differing from the previous one in that it has been made on the aftertreatment models of the case, leaving the six anterior teeth just as they were in the finished case. Several observations can be made:

1. The arch is too long and narrow because of basal arch deficiency.
2. The third molars would have had to be removed, even if the movements were possible, as they would have been impacted. These teeth extend beyond the tuberosities, the limits of which are indicated by the posterior part of the model bases, which were planed just in back of the tuberosities.
3. The crowding of the mandibular incisors in the finished case was a result of disharmony of tooth material.

The tip of the left maxillary lateral incisor was accidentally broken off, but not repaired, because it allows a clear view of the good relationship of the maxillary and mandibular cuspids. Certainly the incisors should not be moved forward to eliminate this crowding of the mandibular cuspids, nor can the mandibular cuspids be moved distally without moving the maxillary cuspids distally also in order to preserve their proper relationship. This would mean that if the crowding of the mandibular cuspids is to be eliminated, all of the maxillary and mandibular teeth distal to the lateral incisors would have to be moved distally, which would open spaces between the maxillary anterior teeth. These spaces were present in the previous setup shown in Fig. 4, because in that setup the mandibular incisors and cuspids were aligned with unbroken contacts, and the maxillary incisors had to be spaced because of the disharmony in the maxillary and mandibular tooth material. Such spaces could probably not be maintained even if they were desirable.

The photograph of the boy at 18 (Fig. 8) presents no "dished in" appearance of the face, not only because the teeth are in normal relationship with their supporting bone, a condition over which I had some control, but also because the basal arches bear a satisfactory relationship with the facial plane, a condition over which I had no control.

MESSAGE FROM THE GOVERNOR OF THE COMMONWEALTH OF MASSACHUSETTS

HON. PAUL A. DEVER, BOSTON, MASS.

Mr. President, Distinguished Orthodontists, Ladies and Gentlemen:

Confessedly I do not come to you at this noontime with any significant message. I am not entirely sure of the occasion upon which I tentatively accepted the prospective invitation to be here. It might have been between hands of bridge at a Boston club wherein Dr. Adams indulges in his nonprofessional activities, or maybe it was during a symposium on the "Queen Elizabeth" when I was returning from Europe with Dr. Margolis. I am sure that during that symposium I learned more about the highly specialized profession in which you are engaged than I ever knew before. Yet out of that I could bring to you nothing of an appealing knowledge because, being a rank amateur, and being, of course, a Democrat, I do not have to indulge in the art of making crooked things straight. I do, however, seize this opportunity to welcome this distinguished group of professional men to the Commonwealth of Massachusetts. This, to a large extent, is the Commonwealth wherein American liberty was born, and wherein for the past one hundred seventy-five years all of different strains and varying traditions have pursued their way of life under the protective influence of constitutional guarantees unimpeded by unworthy actions of others. Yet Massachusetts, zealous as it is of a rich tradition and of an abundant contribution to the well-being of the republic, does not, as some suspect, live only in the past. We are a growing, a dynamic Commonwealth. We are rather proud of our contribution to the art of public health and the private treatment of those afflicted with illness, and in these days even more concerned in the prevention of affliction by the inroads of plague or sickness.

Massachusetts is proud of its two great dental schools. For at least the past generation they have trained young men for the service of society in the treatment of those illnesses occasioned by diseased teeth. As the Governor of the Commonwealth, much more than you might believe, public health is one of my major concerns. It would, as I indicated at the outset, be unjust for me to discuss problems that are yours. At times, I feel there is a lack of justice on the part of the public in untutored intrusion into problems that are governmental, not that it is not the concern of every citizen as to what makes the machinery of his government go around, but it should be an intrusion that is based upon intelligent appraisal of the problem.

Presented before the Northeastern Society of Orthodontists, March 6, 1950.

I think it will perhaps come as a shock to the citizens of Massachusetts present at this meeting, to have me make the statement that of every dollar which the state collects by way of taxation, 53 cents is returned to the local cities and towns of the Commonwealth to aid in their educational and welfare problems. Most of our charitable departments in the governmental setup are self-supporting. Of the remaining 47 cents which is expended by the Commonwealth, by far the major part is spent in the prevention and the cure of human disease. That is your particular field.

We are proud, of course, that Massachusetts stands, in our opinion, at the very top of the states of the Union in the treatment of those who have been robbed of sound mental processes, either through the incidence of an inscrutable Providence or due to the tremendous pressure of modern life. When we say that we think Massachusetts stands at the top, we are buttressed by the truth which the record reveals, i.e., that for the first time in the history of the Commonwealth—and we suspect, uniquely, in the nation—our mental health hospitals have discharged as cured during the past year a number equal to those admitted for treatment. So rapid has been the advancement of the psychiatric art, it is now prophesied that, of the 30,000 patients which we take care of in our many mental health hospitals, 23,000 of them are psychotic and, therefore, susceptible to cure by modern medicine.

I want to leave with you the thought that the prime concern of state government today is the health of its citizens. I know of no one in the entire Commonwealth who believes in what could properly be characterized as socialized medicine. I do, however, view with chagrin an inadequate appraisal of some welfare programs that, through lack of proper reasoning, are intertwined with a menace of what constitutes socialized medicine. We are proposing, for the Commonwealth, a contributory system of unemployment compensation payable when the unemployment is caused by nonindustrial involuntary illness. For the past forty years there has been a system which has not been contributory, whereby compensation is paid for the period of time that an individual is disabled from illness or disability occasioned by industrial accident. During those forty years there has been no attempt on the part of the Commonwealth, which controls the system, to intrude upon the professional aspects of the medical or dental professions of the Commonwealth. There is no menace to the autonomy of the professions dedicated to the relief of human ailments in the passage of legislation to give compensation occasioned by involuntary illness. You now have such a system in the State of Rhode Island, in the State of New York, and in the State of New Jersey—three states included within the jurisdiction of this organization—and there you have witnessed nothing except this: that during the period of disability occasioned by that illness there is a financial capacity in the recipient of the benefit to pay for the treatment which he receives. I would urge upon the medical and dental professions a willingness to cooperate in the passage of systems designed to retain the personal dignity and the financial stability of those who may be disabled because of involuntary illness and to which system such an individual has contributed from his employment compensation.

Such legislation is coming as sure as the sun rises in the morning and sets in the evening. It is a natural expansion of programs which have proved their worthwhileness during the last half century.

I can speak for all of the people of a great Commonwealth, and in speaking for them I bring to you our deep appreciation for the advances for which you are responsible over recent years in the dental art. The orthodontist has in many fields led the way for these advances. A grateful citizenry feels indebted to you and, therefore, for you and for your organization I wish many, many years of happy existence.

DR. EDWARD HARTLEY ANGLE—HIS INFLUENCE ON ORTHODONTICS

BERNHARD WOLF WEINBERGER, D.D.S., NEW YORK, N. Y.

THERE assembled during the month of September, 1887, in the city of Washington, as a part of the Ninth International Medical Congress, a group of men then in the prime of their professional career. This section, under the chairmanship of Jonathan Taft, was there to discuss various problems of dentistry. Among the many papers presented were some ten in number relating to correcting "irregularities of the teeth." Besides the older men, such as Drs. E. Parmly, William Allport, A. L. Northrup, L. Shepard, C. F. Boedecker, others present and taking part in the meeting were Drs. E. H. Angle, Calvin S. Case, Victor Hugo Jackson, J. N. Farrar, E. S. Talbot, C. I. Goddard, and S. H. Guilford, all young men just entering the profession and destined to play a most important part in the furtherance of our particular field of dentistry.

I believe it can be said that at that session these men met for the first time, to begin their intense rivalry. Even at that meeting, if one would read the transactions, he would find that the battle was well under way, and continued until each had passed on to the Great Beyond.

Only those who knew them personally, and it was my good fortune to have had this pleasure, and who were in practice during the period of this bitterness, can appreciate what they did to elevate our branch of the dental profession.

I wish that I had the time to include this story so as to have the proper background for this talk and also that I might review briefly the activities of each of these men, for all played a most important part in bringing "orthodontia" to the height it reached in 1915. They were the incentive for others to study, to reflect, and to work.

These men were the most prominent in "orthodontia" and were in possession of the best knowledge of the day. They therefore exerted a strong influence in establishing the trend of treatment. While they often disagreed with respect to various methods, and frequently assumed an uncompromising attitude toward the use of certain types of appliances, they were always striving to improve conditions and advance the profession of the then so-called "orthodontia."

How many who are practicing orthodontics today understand the processes involved in its development and what its specialization has meant to dentistry? It is my wish to speak of the activities of one individual and to cite his efforts and great influence upon others, for it was Dr. Angle who brought harmony out of chaos and changed the idea of "straightening teeth" to that which we today know as orthodontics.

Presented before the graduate students of the University of Pennsylvania Graduate School of Medicine, Department of Dentistry.

There were others, as I have mentioned, who sought the same goal, many of whom were guided by the same motives and who were outstanding men, but, working as individuals, their efforts were thereby less effective.

As I approach the subject, doubt assails me lest my motives be misunderstood. Dr. Angle's name is already well recorded upon the pages of history, and it is not my intent to place a group of men and their efforts upon a high pedestal of fame. There was, however, something unique in that period of American dentistry that made Dr. Angle and his pupils outstanding; therefore what I have to say should be considered impersonal. Having lived through a great part of this evolutionary period, and I might say having been a part in it, perhaps I might convey to you who are just entering its domain something of the spirit of the time.

Dr. Angle's earlier struggles against innumerable and seemingly insurmountable hurdles continually placed in his path are forgotten, or, more likely, are unknown to most orthodontists of this generation. His earlier ideas and contributions have long ago been lost sight of in the gradual development of his thought and the evolution of the theories he continuously promulgated.

To understand better and appreciate more fully the lifework of Dr. Angle, his difficulties, his reaction to the ideas of his own contemporaries, and his efforts with his own students, it might be in order at this time to review his early life briefly.

Born on June 1, 1855, the son of a farmer, at Herrick, Bradford County, Pa., Dr. Angle spent the first eighteen years on a farm. A visit to a dental office turned his mind in the direction of dentistry and he determined to enter that profession. Graduating from the Canton, Pa., High School, he first became apprenticed in a dental office, later entering the Pennsylvania College of Dental Surgery, graduating in 1878. That year he began the practice of dentistry in Towanda, Pa., but, being in poor health, he had to give up dentistry and sought to regain his health in the west, something he was compelled to repeat forty years later.

According to Angle, he became interested in orthodontia as early as 1880, and in 1885 accepted the chair of orthodontics at the University of Minnesota, the first such professorship established. There he remained until 1892.

In December of 1885, before the Minneapolis Dental Society, Dr. Angle presented to the dental profession his views regarding the treatment of irregularities of the teeth. In July, 1886, in a paper before the Minnesota State Dental Society, he enlarged upon these ideas, where it received much favorable comment.

He was asked to repeat this paper at the Ninth International Medical Congress in Washington, September, 1887. The paper entitled "Notes on Orthodontia, With a New System of Regulating and Retention" was later published as "The Angle System of Regulating and Retention," and became the first edition of seven of his "Malocclusion of the Teeth."

Instead of the favorable comment Dr. Angle received in Minneapolis, the discussion, as reported, centered mainly upon the question of priority of dis-

covery, and not concerning the value of his proposed treatment and method nor a consideration regarding the movements of teeth. The closing discusser aptly put the question in these words: "Dr. Storey of Texas inquired whether the object of the Section was to establish principles for guidance in the practice of the profession or to establish the procedence of certain better inventions. Instead of wrangling over the question of priority, each of the claimants should have said: 'Gentlemen, here is my discovery; you are welcome to it.' "

Dr. Angle thus entered his lifework in the midst of criticism, attack, and antagonism. How far-reaching was this influence, what was his reaction to it, and how did it react on the development of orthodontia?

Could Dr. Angle have been able to devote his remarkable talent unhindered, without ill feeling being constantly displayed against him, no one could state how far orthodontia would have progressed.

His early struggle in behalf of what he then believed to be correct and sound, and which is today universally accepted as such, was confronted with constant opposition and bickering. Fortunately, this served only to spur him on to even higher ideals and greater perfection.

The fundamental facts he strove so eagerly to convey were so slowly accepted by the dental profession that this only served to widen the breach and increase his own difficulties. Though he tried to hasten the acceptance of his teachings, the dental profession was not ready to admit, adopt, or welcome his doctrines.

Dr. Edward Hartley Angle was one of those rare geniuses of whom there are but a half dozen in the history of American dentistry.

A man of great vision, he was able to surmount the greatest of difficulties and disappointments, overcoming bigotry and personal animosities, hurdling impediments that were constantly placed in his way early in his orthodontic career. Under these circumstances and environment he followed that vision, developed and nourished it, and lived to see the dream materialize.

No other pioneer worker in dental history has had the good fortune to live to see his ideas so generally accepted, his ideals carried forward and universally practiced, as did Dr. Angle. He lived to cultivate orthodontics, a long-neglected child of dentistry; he helped to raise it to maturity and eventually to become a most vital branch of the mother profession.

Added credit should therefore be given to the man whose logical demonstrations and perseverance finally succeeded in taking the practice of orthodontics out of a chaotic condition and making it a well-organized and regulated specialty.

Provost Smith, when conferring the honorary degree of Doctor of Science, at the dedication of the Thomas W. Evans Dental Institute in 1915, expressed the following tribute to our great preceptor: "Lover of art and Nature, intimate friend of trees and flowers, but preeminently founder of the science of orthodontia, to which the best thought of a life has been given in experiments and in test."

No one man in orthodontics did more to foster this phase of dentistry; introduced more general theories that later became accepted laws; succeeded

in devising a more universal system for treatment and types of appliances for correcting the deformities of the mouth.

In 1892 Dr. Angle resigned from the University of Minnesota to accept the professorship at the American College of Dental Surgery, now the Dental Department of Northwestern University, where he remained for six years.

Up until that time dental students were not required either to purchase books or own their instruments. Dr. Angle insisted that every student had to have both. The idea did not appeal to either the students or the faculty, and Dr. Angle then realized that at that stage the profession was not ready for his advanced ideas so he said: "Gentlemen, you have my resignation." Here he pioneered too, for he wanted his pupils to have at least the materials that would enable them to obtain something out of what he was trying to teach them.

He then endeavored to have the University of Pennsylvania form a separate department but found that the avenue of teaching orthodontics was forever closed to him in the colleges of dentistry.

ORTHODONTICS AS A SPECIALTY

In 1896, before the Western Pennsylvania Dental Association, Dr. Angle delivered the first of his talks advocating the teaching and practice of orthodontics as a specialty of dentistry, but it was not until three years later that he "became filled with the belief that if orthodontia was to make material progress, a separate school, entirely independent of dental schools must be formed, which would amply provide opportunitiy for those with aptitude and liking for the subject to study in a broad, thorough and comprehensive manner. . . ."

Not having been successful in persuading the dental colleges to teach orthodontics as an optional course after the second year, for that idea was "too utopian" or "too early," Dr. Angle, though discouraged as he was, went to the Niagara Falls meeting of the National Dental Association in 1899. There he found four men, Henry E. Lindas, Thomas B. Mercer, Herbert A. Pullen, and Milton T. Watson, who were willing to spend three weeks with him in his office in St. Louis.

There he was able to divorce himself from the handicaps of the dental college and to surround himself with young men who were willing to study orthodontics in the broad and thorough manner that he had outlined for them. This was the beginning of the Angle School of Orthodontia, although the establishment of the first postgraduate school in dentistry actually did not take place until a year later when the four men mentioned returned, along with Charles B. Blackmar, Frank A. Gough, Fred C. Kemple, Lloyd S. Lourie, Grafton Munroe, R. W. Rafter, and Richard Summa. With the exception of two, all were later to have their names indelibly inscribed upon the pages of orthodontic history.

I will not take up your time with a further account of this interesting and important phase of our history as last year I went into the subject in some detail (Am. J. Orthodontics, April, 1949, pp. 297-308).

TECHNIQUE

The establishment of a school of his own permitted Dr. Angle to try out ideas he had been formulating over the years. He planned to give his students

the technique he himself had mastered, and that would enable them to carry out tooth movements, for he realized that the mechanical requirements of orthodontic treatment were related to physiologic reactions and therefore insisted upon a consideration of these relations.

He had by that time realized that the teaching of orthodontics differed considerably from that of dentistry. While both had a common basis and a common grounding in the principles of medicine, dentistry was interested in the cure of disease and the repair of its ravages, while orthodontic's interest was in the development of a human denture and in the biology of the development of a biologic mechanism. Malocclusion not being a disease was seldom associated with pathologic processes, for it is a defect in development.

Orthodontics is related, he said, to dentistry only in that it originated in dentistry. Until then men had been thinking of alignment and of occlusion in the sense of teeth hitting one another and of moving of teeth without any reference to whether that was where they belonged in the denture or not.

The breadth of vision of Dr. Angle was also indicated by his insistence that orthodontic work requires such development of technique and breadth of understanding that the best results can be obtained only by those who devote their lives to this work. To the attainment of this end he established his school.

While there are certain techniques in dentistry that apply to orthodontics, a new one independent of dentistry had to be developed. In dental soldering the maximum of solder and the minimum of plate are used. Orthodontic soldering is founded upon the principle of uniting two pieces of metal with the minimum of solder.

Dental technique depends upon placing the pieces in solid investments and thus holding them together until united, while in orthodontia one must acquire a skill to soldier small pieces of metal with the free hand. Those who took the Angle course well remember the hours and effort spent trying to complete the famous "telegraph poles."

Dr. Angle was constantly trying to improve upon his own technique, for he was never satisfied with anything that could by any possibility be improved, and he insisted upon his students returning year after year so that they might work at the bench with him to master the new type of appliance he had devised.

NORMAL OCCLUSION

Dr. Angle was not merely an inventor of new appliances; he was a philosopher as well in his own field, always searching most diligently for the basic principles that lie behind the operative measures in corrective work. Apparently very early in his career he clearly saw that in the absence of fundamental principles each case had to be treated on its own merits, for otherwise diagnosis would be difficult and too much would then depend upon the mere personal opinion of the operator.

In the course of his thinking along this line he hit upon the great generalization of "normal occlusion" as the starting point and then developed from this his classification of malocclusion.

Having had the good fortune to examine some skulls with exceptionally fine dentition he observed that the teeth were evenly aligned and well preserved, and that when the opposing jaws were brought together, the teeth came into contact in what Henry F. Osborn then called "mechanical relation of the upper and lower teeth," in dentistry "articulation of the teeth."

Impressed by the dental equipment of an adult having all thirty-two teeth, he decided to use it as a model for efficiency and for perfection and that it would serve as an ideal in orthodontic practice. This gave him the basic point to start from and the objective to aim at. Instead of using "the mechanical relation" he substituted the term "occlusion" and used the term "normal" to indicate the ideal, the superlative.

"Normal occlusion," as Angle wanted others to recognize, is of fundamental significance because it implies those requirements which are essential for functional efficiency.

By 1907, in Angle's "Malocclusion of the Teeth" he came to the conclusion that occlusion presents not only "the normal human denture in its completeness," but it also "includes the jaws, alveolar process, dental arches, and especially the teeth and peridental membrane, which to us are of prime importance." He also includes "the muscles of the lips, cheeks, tongue and mouth, the nasal passages, palate and throat, as these assist the teeth in performing their functions." To him, "the sizes, forms, interdigitating surfaces, and positions of the teeth in the arches are such as to give to one another, singly and collectively, the greatest possible support in all directions." "Each tooth," he says, "is not only in harmonious relation with every other tooth, but also helps to maintain every other tooth in these harmonious relations, for the cusps interlock and each inclined occlusal plane serves to prevent each tooth from sliding out of position, and, further, to wedge it into position if slightly malposed; that is, if not beyond the normal influence of the inclined planes." Therefore, he defined normal occlusion as being "the normal relations of the occlusal inclined planes of the teeth when the jaws are closed."

Just as now, Angle was then confronted by the all too frequent extraction of teeth for "regulating" purposes. In order to avoid misunderstanding, he taught, for he believed as many of us still do, that "normal occlusion" could be achieved without extraction and therefore formulated what he thought was a basic concept. The law, as he proclaimed it, is that: "The best balance, the best harmony, the best proportions of the mouth in its relations to the other features require that there *shall be the full complement of teeth and that each tooth shall be made to occupy its normal position.*

In framing this law, Angle contributed to orthodontics a basic concept and a scientific aim. This was in the face of much opposition from orthodontists of the period, some of whom insisted, just as some do at the present time, on the extraction of the premolars to reduce the length of the dental arch. Angle had seen clearly that any attempt to reconstruct a rounded arch in a long-headed individual, or vice verse, was to commit a crime against Nature, and that even if such an anomaly were created it could not be retained in opposition to the natural correlation of structures.

What Angle failed to realize, however, was that the "normal" was in reality but an "ideal occlusion," something to shoot for, and that it had no biologic justification nor scientific foundation. It remained for Milo Hellman, in 1921, to point out that "the imaginary ideal cannot be found and that Nature's ideal as expressed in the form of type represented but the average and its standard deviation."

The idea of "normal occlusion" had its origin in orthodontia, came into dentistry, into general science, biology, evolution, comparative anatomy, and anthropology.

CLASSIFICATION

In endeavoring to solve the problems in orthodontics, Angle then sorted out the varieties of occlusion, as found in dentition deviating from the normal, and systematically separated them into three classes, devising an appropriate technical means for gaining orthodontic ends in accordance with his basic concept of the problem as a whole.

Through this classification he brought law and order into the prevailing chaos pertaining to the conception of the manifold forms to which "irregular teeth" gave expression. Though many attempts had previously been made, as I described this afternoon, no one succeeded in working out and bringing to the attention of the profession a classification so *simple* as that of Dr. Angle, and while many attempts have been made, during the intervening years, to improve upon it, it still remains the accepted "yardstick."

Because of its simplicity, the Angle classification unfortunately does not convey exactly the same idea to everyone. Referring to his classification, he says, "These classes are based on the mesio-distal relations of the teeth, the dental arches, and jaws, which depend primarily upon the positions mesio-distally assumed by the first permanent molars on their eruption and locking." In the statement a number of ideas are implied, each of which is independent of the other. First, we have the foundation upon which the classification is based; second, a means of diagnosis; third, though not indicated but suggested, a means of treatment, and, finally, a terminology explaining classification and diagnosis. Due to the variety of interpretations of the fundamental principles, a diversity of opinions has therefore arisen, giving rise to various sorts of misunderstandings.

This classification with Angle's determined stand against extraction will, however, always be a lasting memorial to him.

FACIAL EXPRESSIONS

Dr. Angle's vision of the restorative process carried him over into the field of art, especially as related to the balance of structure in the human face. There was a time when he had the idea that certain portions of Greek art were the very height of beauty and that every face should be an Apollo Belvedere. There were others then, as well as to today, who thought along similar lines. Calvin S. Case, for instance, expressed the opinion that "one should be able to see in the mind's eye the symmetrical outlines to be worked for or towards in the correc-

tion of the case in hand. . . .The facial outlines of this figure will be employed throughout classified malocclusions as a standard of comparison, solely for the purpose of showing the probable degree of disharmonies in the facial outlines in different characters and types of protrusion and retrusions of the teeth and jaws." His purpose was to make all faces whose dentitions were in "malocclusion" conform to this standard. This undoubtedly will have a familiar ring to some.

Well do I recall Prof. Edmund H. Wuerpel lecturing, "Every type of individual hearkens back to certain ancestry. The Nordic mind is one thing; the Mediterranean mind is another, each develops through different circumstances. Although one might tell me his ancestry is distinctly American, or Colonial, you have the mind of a Nordic." By transposing the word "mind" for "teeth" one will find the significance of Wuerpel's statement.

In 1907 (the seventh edition) Angle was of the opinion that "the study of orthodontia is indissolubly connected with art as related to the human face. . . . While all human faces are greatly alike, yet they all differ. . . . Lines and rules for their measurements have ever been sought by artists, and many have been the plans for determining some basic line or principle from which to detect variations from the normal." He further remarked, "We should be able to detect not whether the lines of the face conform to certain standards, but whether the features of each individual—that is, the forehead, the nose, the chin, the lips, etc., balance, harmonize, or whether they are out of balance, out of harmony, and what concerns us most as orthodontists, whether the mouth is in harmonious relations with the other features, and if not, what is necessary to establish its proper balance."

Thinking along these lines Angle formulated "that there is a law for determining the best balance of features," as already mentioned.

As more knowledge was gained relating to growth, Angle's idea had to be somewhat modified, for J. V. Mershon rightly maintains "that normal growth produces a normal face" and that when "growth has gone wrong, it results in an abnormal or deformed face" and that the "deformed face" through orthodontic care "is transformed into the normal face." Thus Angle's picture as a whole has not been altered to any great extent.

Every orthodontist knows by experience that the extraction of permanent teeth for children is purely a speculative procedure in so far as the ultimate effect upon contour of facial bones is concerned. The loss of two, four, or even eight premolars arrests facial development and expression and is far more damaging to the patient's future than crowded anterior teeth, for this procedure never overcomes faulty muscular pressure. Angle's dictum that the full complement of teeth and that each tooth shall be made to occupy its normal position is just as important today as it was when the law was laid down.

Orthodontic progress has been furthered, not alone by investigators who have made original observations and experiments and have recorded their results, but also by those orthodontists who from time to time have taken stock, as it were, of the knowledge existent, and presented it to the profession in organized form, and who sought the cooperation of, and obtained knowledge from, correlated sciences.

When we look back into the past we find that occasionally there appeared an individual with such marked ability that he could immediately be singled out from his contemporaries. His predominance was destined to alter a profession's progress, and not only did he bring about tremendous changes himself, but he was able to lead others who have and will accelerate evolutional changes. Such was Edward H. Angle. It was inevitable that a man with so strong a personality should influence the development of dentistry and orthodontics and found a new school along new ideas.

Though Angle was not what we today might call a research worker, he was one of those rare individuals who tried to see through things and did organize the then orthodontic knowledge so as to prepare it for general diffusion.

There are few great professional men whose value has been so variously esteemed as that of Dr. Angle. In his lifetime he was regarded as authoritative, to a degree in which he was not rivaled or excelled. His writings acquired a canonical status. Many today, however, describe him as a false prophet, and because of this atmosphere of uncertainty, it is difficult for some to form just views regarding him and his teachings. That which made Angle's influence so pervasive was the fortunate circumstance that he came to the right place at the right moment.

Angle must be given credit for possessing an uncanny ability to select and coordinate those things which were of value in the practice of orthodontics. His work became recognized as having unusual merit. His conception and application of occlusion, his uncompromising attitude toward the extraction of teeth, his high ideals, fine technical skill, courage of conviction, inflexible personality, and lofty aims stamped him as the most powerful influence in the realm of orthodontia.

When Angle determined that orthodontia was to be a specialty, he realized, like Chapin A. Harris, that for a secure foundation three things were required: first, a school, in order to instruct future adherents; second, a society as a forum of exchange of knowledge and fraternal intercourse; third, a journal, so that knowledge acquired might be disseminated and the specialty stimulated.

Dr. Angle's professional life may likewise be divided into three definite stages: first, his relation to dentistry up to 1900; second, the period comprising the Angle School of Orthodontia, 1900-1913; finally, the Angle College of Orthodontia.

ANGLE'S STUDENTS

Dr. Angle desired of his pupils not merely to be good technicians, but to become real students, investigators, and thinkers. While he believed he never succeeded in accomplishing this, the record proves that he was wrong.

The establishment of the Angle School laid the foundation of orthodontics as a specialty, and in order to fulfill the requirements he helped organize in 1901 the Society of Orthodontia, now the American Association of Orthodontists, and was instrumental in founding the publication of the first independent jour-

nal, the *American Orthodontist*, in 1907. Thus we find, as in the case of Chapin A. Harris, in 1839-1840, that Angle did for orthodontics what Harris did for dentistry.

As Mark Hopkins once remarked, "Students are not merely vessels to be filled, but fires to be lighted." Those students who came under Angle's influence certainly left the school instilled with his spirit and ideals and, what was even more important, a broader vision of what should constitute orthodontics. The fires he lighted have continued to burn to this very day, for one has only to look at the names of those who have contributed to orthodontics since 1900 to realize the power and influence of Dr. Angle as a teacher. Those whom he taught lighted the way and guided the direction orthodontics was to take, because of the spirit and great vision he possessed and the high ideals he so successfully inculcated in his students.

It is not strange that opinions arose which did not coincide with Dr. Angle's, as there were among the men many who thought for themselves, openly expressed their own ideas, and thus entered into open conflict with him; yet, deep down in his heart, Dr. Angle must have enjoyed these controversies, for it no doubt indicated to him that his students were not puppets but thinkers, alive and active, resulting in a further stimulation. Certainly this spirit did bring about desired results, and thus was the spirit instilled and kept alive.

Recently, in reading over some early correspondence from Dr. Angle, I came across the following: "Now do not let what I have written in any way disconcert you. Give your paper before the society as you have written it. It won't kill them, but will do them much good and you far more good." It was this spirit that produced a stimulus sufficient to cause men to investigate various fields of science and to think beyond the mechanical phase of treatment.

At the time Angle was contemplating that "orthodontia" should be a specialty, he gathered around him and on his teaching faculty, for the first time, specialists in correlated sciences and art. In this manner the broad vision he had could more easily be carried forward, for this association of student and teacher opened up varied fields of advanced study, and in many cases lifelong friendships resulted, to the advantage of both. It would not be fair to claim that he was better able to judge his future students during this particular period than later, but there can be no question that those then chosen made their influence felt to a much greater degree.

Now permit me to present briefly what the graduates of the Angle School did accomplish. Upon an examination of Black's "Index of Dental Periodical Literature" it surprised me to find such subjects as biology, physical anthropology, endocrinology, diet, nutrition, and many of the other important related branches of science almost unknown until after 1910, and in some cases till 1920. When found, it appears that such papers were first presented before an orthodontic society. Thus one immediately sees the influence and the direction of study with which the orthodontist was primarily concerned and introduced into dentistry. Again, if previously found, the material was usually from the standpoint of, and presented by, a dentist.

Next to the founding of the Angle School of Orthodontia and equal in importance to the Society in advancing all phases of the science was the third-named factor, the journal, so that the knowledge acquired might be promptly disseminated. Naturally, the *American Orthodontist*, published from June, 1907, to October, 1912, strongly shows the influence of Angle. The writings, however, present the studious nature of those pioneers, and there is probably no finer collection of orthodontic papers in existence than those contained therein. Besides this journal there were two other American dental publications edited by two men who also had sufficient foresight and interest and who sufficiently understood the value of specialization to give orthodontia not only sufficient space, but went out of their way to stimulate and establish new contacts. Adequate credit has never been given to either of these men—Rodrigues Ottolengui and Edward C. Kirk. Beginning with the first meeting of the American Society in 1900 and for twenty years, Dr. Ottolengui reported those meetings in such a manner that it created for orthodontia a tremendous interest in the profession. Often he received for the *Dental Items of Interest*, from some obscure person, an independent paper of sufficient interest which he immediately referred to the Program Committee of the American Society of Orthodontists, requesting that it be read at their next meeting, and thus started many a man, without his knowledge, upon the road to prominence; later such paper did appear in print.

Dr. Kirk likewise opened up the pages of the *Dental Cosmos*, and the success of the Eastern Association of Graduates of the Angle School was largely due to his generous interest in furnishing an outlet for the material and comprehensive reports of the meetings, over a long period of its existence. Where Dr. Kirk left off, Dr. L. P. Anthony ably stepped in, continuing to aid on every occasion.

Upon the termination of the Angle School of Orthodontia, Dr. Martin Dewey, a graduate of the school in 1902, one of its important teachers as well as the first editor of the *Angle Orthodontist*, undertook to carry on Angle's teachings by establishing the Dewey School. For a number of years he met with some success, turning out some excellent men during the time the school was run upon the broad principles laid down by Dr. Angle.

In 1913 an attempt was made to have Dr. Angle support a journal to take the place of the *American Orthodontist* but he unfortunately could not at the time see the importance of such a project. Dr. Dewey, with the valuable assistance of Dr. C. V. Mosby, of St. Louis, was not to be easily discouraged, and in January, 1915, issued the first number of the INTERNATIONAL JOURNAL OF ORTHODONTIA AND ORAL SURGERY. The early numbers show how strongly Angle's influence, through his students, had permeated into orthodontics.

This journal became the official voice of the American Society, now Association, of Orthodontists and its component societies.

In January of 1931, the Edward H. Angle Society of Orthodontists, graduates of the Angle College plus selected students of the Angle School, published the first issue of the *Angle Orthodontist*. It is through both of these channels that Dr. Angle's teachings still continue and predominate.

There can hardly be any question as to the influence of Angle upon, and the scientific tendencies of, his graduates. Here we find the answer how orthodontics became a scientific profession. That his teachings and ideals still prevail in orthodontic societies is a lasting tribute to its organizer. Through some of the Angle graduates this spirit has been transmitted to their students, and predominates within our specialty today. It likewise has been carried into dentistry itself either directly or indirectly, and thus the profession as a whole has benefited thereby.

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ORTHODONTICS AS AN ADJUNCT TO ORAL SURGERY

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WITH the ever-increasing trend toward specialization in the various fields of dentistry and medicine, there must be frequent conferences between those specialties so that the best of their knowledge can be applied to the benefit of all concerned. In the field of oral surgery there are many problems that are unsolved and many more in which there is room for improvement. Frequently the answers are to be found outside of surgery, i.e., in orthodontics and prosthodontics.

In this paper there will be discussed a few instances in which the principles of orthodontics have been of value to the surgical team. This is not done as a presentation of something new or advanced, but rather in the hope that it may stimulate interest among the orthodontists in these problems and bring out a more active participation of the orthodontists in hospital dental programs. If such could be done, there would undoubtedly result the development of methods of treatment which would be superior to those which you will find here.

The primary aim of oral surgery is to eradicate oral pathology. Secondarily, but of immense importance, is the maintenance of the function and esthetic appearance of the facial and oral structures. Unfortunately, this second phase has been too often neglected in the past; or it has been considered after extensive surgery at a time when it is most difficult to achieve.

Deformities and deficiencies of the facial structures may be grouped in three classes: developmental, traumatic, and neoplastic. Under the developmental group may be found complete absence, underdevelopment, or overdevelopment of a part. Some of these can be corrected or alleviated by surgery.

Trauma may result in injuries ranging from simple luxation of a tooth to extensive lacerations and fractures with associated loss of soft tissue and bone.

Neoplastic and infectious disease may be of benign or malignant nature and may in itself destroy oral tissues or indicate radical surgery which of necessity will create deformity.

The problems most frequently encountered in all of the above types are:

1. Retention of the facial structures in normal relationship immediately following surgery or injury.
2. Immobilization and fixation of these structures while reconstructive procedures are being carried out.

The orthodontist is particularly qualified to aid in the management of these problems, because of his basic knowledge of the interrelationships of the normal oral structures and because of his familiarity with the construction of intraoral appliances which are well designed for strength and comfort to the patient.

Read before the Washington-Baltimore Society of Orthodontists, April, 1949.
From the Department of Dentistry, Johns Hopkins Hospital.

The best result obtainable by surgery can often be further improved by movement of teeth by orthodontic methods.

The complexities of these problems demand a well-conceived and detailed preoperative plan of treatment. This can only be evolved by intelligent consultation between all concerned, i.e., the oral surgeon, plastic surgeon, orthodontist, and the prosthodontist.

Many unsatisfactory results are obtained by hurried, hasty decisions before operation or by trying to correct the malposition after surgery is done. We have observed that the greatest amount of scar contracture and structural deviation will occur in the first ten days to two weeks after bone loss; also, if the means of fragment stabilization must be removed after that length of time, the deformity will eventually result, but its process will be slower. It has been noted that when trying to correct such a deformity when immediate stabilization had been removed, the fragments were more responsive to repositioning than when no means of fragment relationship maintenance was used in the beginning.

When planning the course of treatment, it should be kept in mind that subsequent surgery may be necessary; a graft may be contemplated at a later date; a tooth may have to be extracted. If so, the structure of the original appliance should be such that its function will be maintained in this event. Therefore, a careful study of each case, its indications or contraindications for treatment, the desired result and how it is to be obtained must be thought out with care preoperatively by all persons involved, working in close cooperation.

The mandible as a functioning unit is most complicated. Its condylar and masticatory mechanics are involved, and any alteration of the normal structure, whether it be by the loss of a single tooth or the loss of a large segment of bone, leads to an alteration of its normal function with resulting impairment of the patient's masticatory efficiency.

The mandible is the largest and strongest bone of the face. Its articulation forms a ginglymo-arthrodial joint, and on its external and internal surfaces there are the attachments of fourteen pairs of muscles. They are equally divided on each half of the bone and have synergistic action when in function.

For simplicity in study, these muscles may be divided into three groups as follows: (1) the muscles of expression which have their insertions in the skin and fascia of the face and are attached to the mandible, but have no direct part in the movement of the mandible; (2) the muscles of the floor of the mouth; (3) the muscles of mastication. This latter group is the most powerful of the musculature of the head and does the most in maintaining proper mandibular position.

All of the muscles in these three groups exert a balanced force for the maintenance of mandibular position, that is, as long as the continuity of the bone is not disturbed. If there is a loss of this continuity, either by trauma, infection, or surgery, the action of the muscles will force the bony fragments out of position. For example: If there is a segment of mandibular bone lost in the left molar region, the temporalis, masseter, and the internal pterygoid muscles will pull the left posterior fragment superiorly; the action of the muscles of the floor

of the mouth, primarily the mylohyoid, will produce a medial pull on the right fragment with subsequent collapse of that side of the face, loss of functional occlusion, and inability to masticate properly.

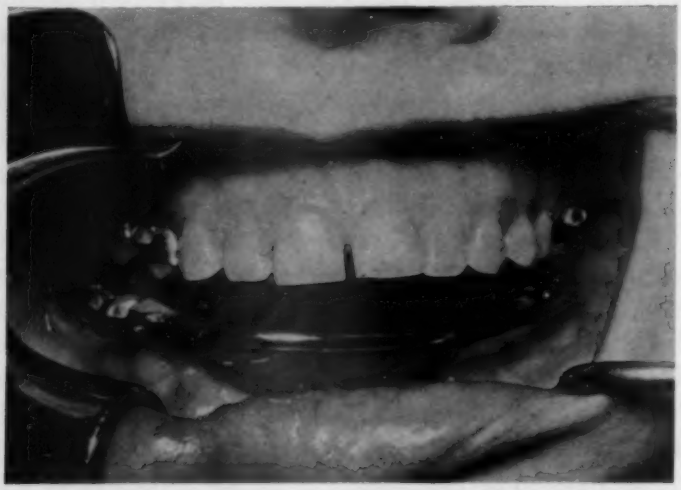


Fig. 1.—Rigid fixation type of appliance used in this particular case to provide rigid fixation and correct fragment alignment of mandible following resection and immediate bone graft to anterior part of the mandible. This is eleven weeks postoperatively taken just before appliance was removed. (Courtesy, Edgerton, M. T., Ward, G. W., and Sikes, T. E., Jr., Plast. & Reconstruct. Surg., March, 1950.)

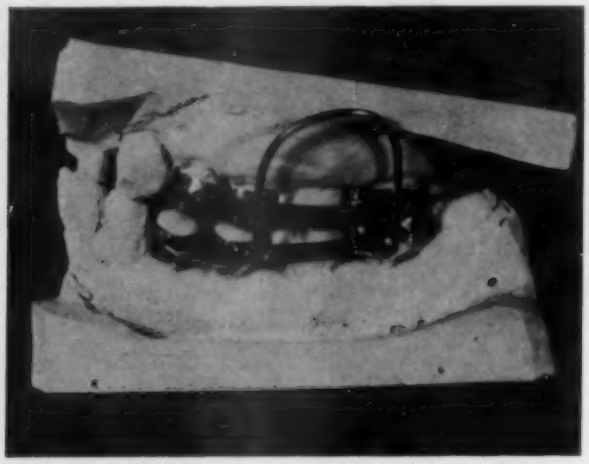
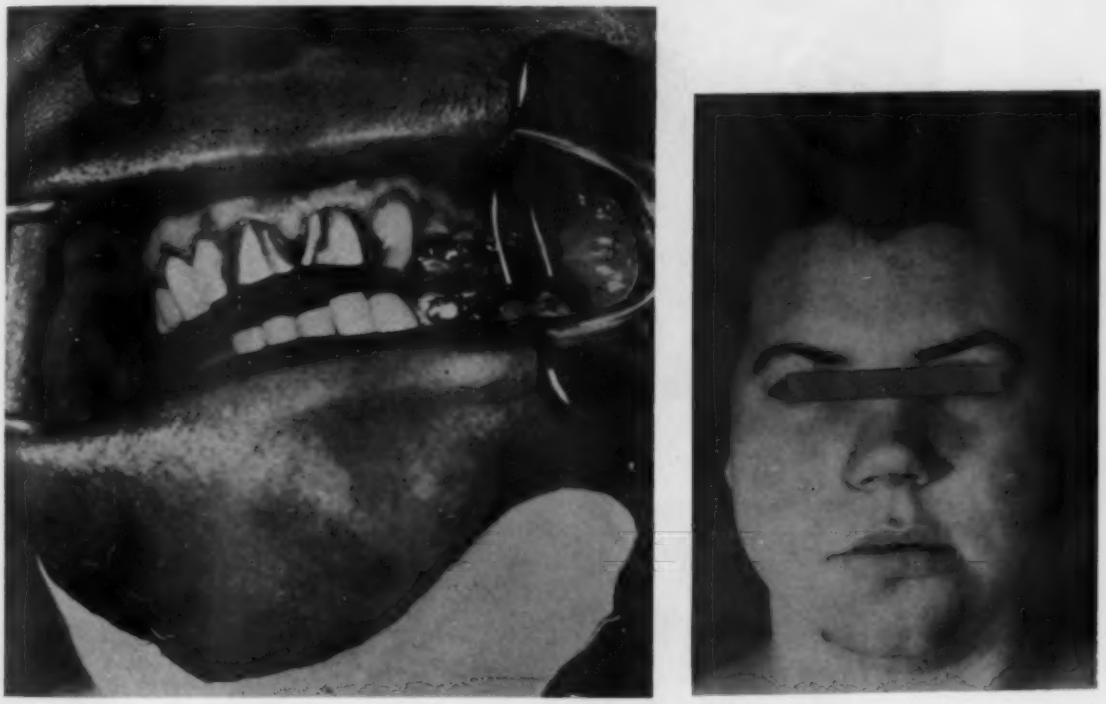


Fig. 2.—The guide plane type of appliance which is constructed for that side of the mandible opposite to the side resected.

When the patient who needs oral surgical treatment that will require the use of an orthodontic appliance presents himself, there are routine procedures which must be done. First, a complete history of the patient is taken and a general physical examination made. Second, indicated intraoral and extraoral radiographs are made. With the use of the radiographic plates and the history, a thorough oral examination is made. Third, impressions of the upper and lower dental arches are made and stone casts constructed. After these fundamental

procedures are done, the oral surgeon, the plastic surgeon, and the orthodontist working together as a team outline the plan of treatment, estimate the amount of surgery necessary, and design the proper appliance for the case.

The types of orthodontic appliances used usually fall into two general groups: (1) those which keep correct fragment alignment as well as provide means of complete and rigid mandibular fixation; (2) that type which will serve as a guide plane allowing motion of the mandible while preventing abnormal deviation. The first type usually consists of the banding of selected teeth with a rigid labial bar attached to the bands. In conjunction with this mandibular appliance, selected teeth in the upper arch are banded with eyelet or hook attachments for means of intermaxillary ligation. (Fig. 1.)



A. *B.*

Fig. 3.—*A*, The guide plane type of appliance in position. This is four days after resection of the right posterior body of the mandible. The patient has the mouth partially open showing that no deviation to the resected side occurs. (Courtesy, Edgerton, M. T., Ward, G. W., and Sikes, T. E., Jr.: Plast. & Reconstruct. Surg., March, 1950.)

B, Patient has guide plane inserted on left side of mandible. Photograph taken five days after resection and disarticulation of right side of the mandible from the first molar region. There is present postoperative edema of the right side but no deviation of the midline of the face.

The second or guide plane type of appliance (Fig. 2) is one which has several of the posterior teeth on one side banded with the bands connected by a half-round labial arch bar. This is constructed for both the upper and lower teeth on the side opposite to that upon which surgery is to be performed. To the lower labial arch bar is soldered a wire loop or guide arm which extends into the mucobuccal fold of the upper jaw and rides on the labial arch bar of the upper attachment. This prevents medial deviation of the mandibular fragment, yet allows adequate motion and occlusion for mastication. (Fig. 3,*A* and *B*.)

From these two basic types most all the necessary appliances can be constructed with variations as the individual case requires (Fig. 4).

After the appliance has been constructed, it should be inserted into the mouth and cemented in place before surgery is attempted. One advantage in this is that the oral surgeon knows that the correct mandibular alignment is being maintained during operation when the exposure is from the skin surface

A.

B.

Fig. 4.—*A*, Variation of the first or rigid bone fixation appliance. The appliance consists of molar and premolar bands to which have been soldered square buccal tubes. The buccal side of the tube on the right has been left open to facilitate insertion of the square labial arch bar.

***B*, shows appliance in *A* in position in the mouth. There is a fracture in the patient's right cuspid region as well as the left condyle.**

and the mouth draped out of the field of vision. It is also advantageous to insert the appliance preoperatively because the usual postoperative discomfort of the patient would be added to by the necessary manipulation which is required in the insertion. Furthermore, when inserted preoperatively, the patient has had an opportunity to become accustomed to its presence before the mental strain of the postoperative adjustment period begins.

The length of time which the appliance must be maintained in the mouth depends upon the type of case and what purpose the appliance must serve. In those cases where rigid fixation is required, such as in bone grafts or fractures, the time is approximately eight to twelve weeks. In the case of resection where the appliance is serving as a guide plane it may be several months. During this period of use, careful attention to mouth care and oral hygiene cannot be overemphasized to the patient.

Fig. 5.—Patient seen in Fig. 3, *B*. A composite rib and cartilage bone graft has been inserted on the right side to replace bone resected five months previously. The guide plane appliance has been wired together with supplemental wiring of teeth on the right side for stabilization.

In the event that further surgical procedures become necessary, these appliances can be easily adapted for use either alone or with supplementary attachments (Fig. 5).

Oftentimes the problem of immobilizing an edentulous posterior fragment arises. It has been found that the use of either external pin fixation of the mobile posterior fragment to the main jaw fragment or the use of internal stainless steel bar fixation in conjunction with the orthodontic appliance gives a very satisfactory result, whether the mandible is to be maintained rigidly or allowed to function (Fig. 6).

As the plan of treatment is carried out, photographs of the patient should be obtained. There should be preoperative, postoperative, and follow-up pic-

tures taken right to the conclusion of the case. These photographs will not only be of value to the practitioner's slide collection, but also will be of aid in case legal difficulties arise in the aftermath of treatment.

Before closing, let me again emphasize the need of the orthodontist on the maxillofacial surgical team. The oral surgeon being the first to become acquainted with the case is responsible for the diagnosis and treatment of that

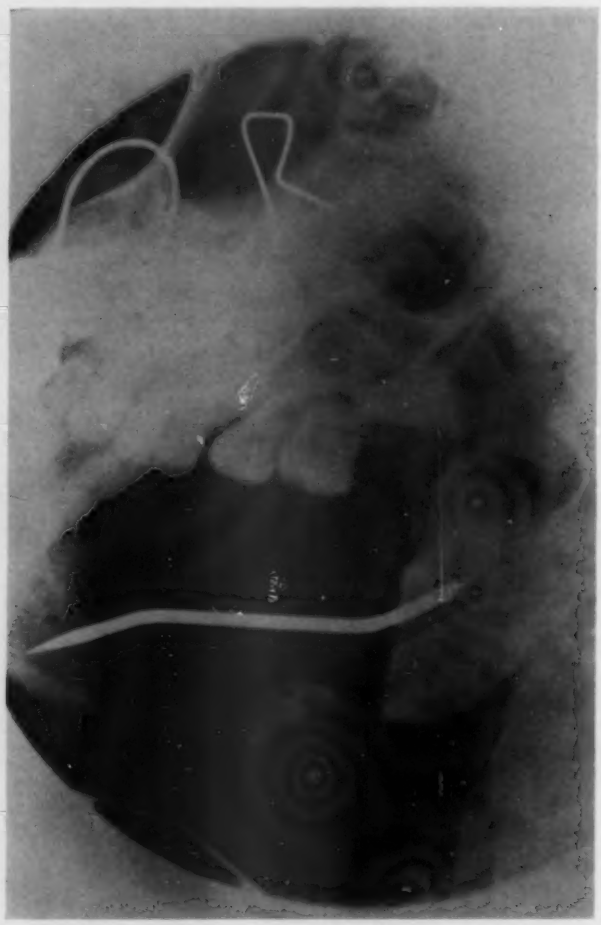


Fig. 6.—X-ray of resected mandible of patient seen in Fig. 3, *A*. An internal stainless steel bar has been used in conjunction with guide plane type of appliance (seen in the upper left by right side marker *R*). This bar was removed six weeks postoperatively after tissues had healed and the early scar formation would not pull ramus superiorly. (Courtesy, Edgerton, M. T., Ward, G. W., and Sikes, T. E., Jr., Plast. & Reconstruct. Surg., March, 1950.)

case. If the case is one of complexity, where there has been complete disarrangement of the oral structures, such as in compound comminuted fractures or following radical surgery, the assistance of the orthodontist is not only welcomed but imperative if correct structural alignment is to be obtained and functional occlusion is to be established. His knowledge would be utilized in the diagnosis, treatment, and prognosis of the case. His part would be the designing, construction, insertion, and maintenance of the necessary appliances for fixation in the following of the treatment plan which he has helped to devise.

In conclusion, first there has been presented the use of orthodontic appliances in maintaining correct mandibular fragment alignment when the normal has been lost by either surgery, infection, or trauma. Second, there has been presented a basic plan for the design of such an appliance which may be altered as the individual case requires. Third, the need for immediate stabilization has been shown. Fourth, there has been emphasized the need for careful treatment planning and close cooperation between the orthodontist, oral surgeon, and plastic surgeon. By following these measures closely and carefully, a satisfactory result can be achieved to the benefit of the patient.

THE MILK STOOL—AN AID TO CARIES CONTROL

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A COUPLE of centuries ago there lived one Dr. Samuel Johnson who, upon departure from this life at the ripe old age of 75 years, left but a few books in which he had recorded his humorous and factual thoughts. Nevertheless, this seemingly small legacy has remained a source of inspiration for many who have trod before the footlights of time's passing parade in days more modern. No doubt you remember his oft quoted, "Men need not so much to be taught as to be reminded of what they already know."

The more we take things for granted, the more easily do they escape us. History has proved that man loses his freedom if he accepts it without question. And Dorothy Dix has indicated that man loses his wife as soon as he starts taking her for granted!

The people, scientists, and laymen alike are fast becoming the victims of their own good fortune. America was first the promised land. Today, it is the I-promise-you land. Every time we are faced with a new problem, we take it for granted that somebody will present us with a satisfactory answer.

A long chain of inventions, such as the cotton gin, the telephone, the atomic bomb, penicillin, and caries preventative procedures, have all been made in direct response to some need. The result is that we have come to expect scientific discoveries, both physical and social, to solve each new problem as it arises. We are comforted by the knowledge that in dire emergencies the iron lung can breathe for us. And we are looking forward to the time when the Lindbergh-Carrel heart is perfected so we may use it interchangeably with our old-fashioned, worn-out natural organ.

We have become a people whose paternal government, either because of us or in spite of us, has stepped into our homes to regulate our children and limit their inheritance, to supervise our farms, and, through the Wage and Hour Law, indirectly to set the time for our burial. Thus, we have become no longer dependent upon ourselves for individual effort or responsibility.

As dentists, we are all familiar with the decreasing ratio of dentists to the population. We are also familiar with the over-all increasing needs of the public. We know that fifteen to twenty times the present number of hours allotted to dental care would be necessary to bring the mouths of the American public to a state of minimum health. All of us are aware of the fact that these conditions have been growing steadily worse since the turn of the century; and that present facilities for the training of dental personnel are not sufficient to maintain even the present ratio.

It is increasingly apparent that the people themselves must again take aggressive responsibility for their own well-being. Whether they will feel this to be a reasonable request I do not know, for I am just a small town boy far

enough removed from the country to know that a cow and a milk stool are highly important parts in the production of homogenized milk and whipped cream which will not sour. The cow of today is a product of nature modified as to production quotas and calcium flow. But a cow is essentially a cow, just as a tooth is a tooth. For years, man had no milking machine manufactured in a distant factory and dependent on the availability of rubber hose or the whims of an electric fuse. Formerly, the milker just sat himself steadfastly on a three-legged stool at the side of his cow, and through his own manual efforts squeezed her dry.

Children are elemental realists and often show adults the way out of a dilemma. If a young child were to draw a milk stool, his tendency would be to draw the seat and one leg in a sort of automatic circle and straight line sweep of the drawing arm so that the identifiable pattern would be established. This simple pattern is comparable to caries control. The first and most important leg is the individual's effort toward reduction of his carbohydrate intake.

After the child has drawn the seat and first leg, he ponders about the placement of the second leg. In caries control, this leg consists of toothbrushing with the approved caries-reducing powders.

Finaliy, after considerable study of relationships to the other component parts, the child draws the third leg on his stool. This third leg becomes the prop which stabilizes those parts which have been constructed previously. In caries control, it consists of care in the dental office and includes such practices as routine scaling and systematic application of sodium fluoride solution.

While each part of a milk stool is important, the seat and the first leg relationship remains of especial significance because it establishes the identity and the pattern upon which the whole is based and brought to completion. These are the essentials of any program of constructive enterprise.

Caries control is simple. It is as simple as A B C. The "A" stands for acidophilous. The "B" stands for bacillus. And the "C" stands for control. It is simply "Acidophilous Bacillus Control." In our relation of dentist to patient, caries control need not be made more complex or confusing than A B C.

Caries control, and I repeat, is simple. Yet it remains a real orthodontic problem. No single controllable factor leads to the production of as much malocclusion as does caries. Hardly need I mention the cases in our practices caused in part or in whole by the early loss of primary tooth material. Of a more serious nature are the thousands of cases of malocclusion that never become our patients. These untreated, perventable cases, and not our relapses, are the tragic failures of orthodontics.

Caries control is simple unless made otherwise. Yet it is natural that the orthodontist who knows that his patient has high caries susceptibility will use greater efforts to prevent the undesirable complications of active decay during treatment.

Dr. Jay's studies were among the first to point out that caries is a controllable bacterial epidemic disease, and that it is rendered less active by a lessening of the refined carbohydrate intake. This is a simple procedure and

does not involve any increased expenditure on the part of the patient. Dr. Jay and his co-workers in the Michigan group also emphasized the need of supplying an adequate protective diet sufficient to maintain the health of patients whose carbohydrate intake was reduced.

Years ago, as predental students, an early lesson in histology taught us that the cell is the basic unit of life and that the body is a group of such units. Food is the source of energy and thus determines the activity of these cells. Tissue and organs are but a number of correlated yet independently acting cellular centers of life. A source of energy which supplies all the elements needed by the cells makes for better cell metabolism and consequently for better cell function. Hence, better tooth formation results. These are simple facts and appear in all histology texts.

Large quantities of refined carbohydrates are not desirable sources of this energy because they do not carry with them the well-balanced diet required by the cells for the sum total of their life processes. Low carbohydrate food is not harmful, as evidenced by the fact that it is prescribed to diabetics and that these patients are not only sick people but are also highly susceptible to infection. The diabetic diet is, therefore, a protective diet in two ways. Caries control is thus somewhat similar to diabetic control. The patient can do much for himself, and the intensity and effects of the disease are governed by his efforts.

Caries control, the control of an epidemic and bacterial disease, is simple. It is not necessary for the public to know the magnitude of dental research. Already the people are confused. They have but a limited knowledge concerning ammoniated powders versus pastes. They are confused about procedures associated with fluoride applications both topically and as an added element in drinking waters. If the dental profession is to succeed in its caries control campaign, simplicity of presentation to the public is of utmost importance.

Caries control should start as soon as the permanent teeth begin to calcify. The dental profession must insist that pediatricians recognize that control is necessary long before the permanent teeth erupt. We must begin to prevent caries during the developmental period when teeth are biologic recorders of health and disease. We must inform parents of young children that decay often appears at 2 or 3 years of age, and that by 4 or 5 years of age, one or more primary teeth may be severely affected. We must teach the general dentist to stop telling parents to wait until Little Johnny is 5 or 5½ years old before bringing him in for an examination or cleaning. These parents should be told to bring Little Johnny in by the time he is 3 years old so that his caries control program can be discussed and started. I have never found a child who enjoyed having toothache. If approached properly, some children will help to prevent this pain, especially if given a chance by the fond mama.

Since many children will partake of sugars at odd times and in odd places, we need only to impress upon them that it would be highly desirable if they would carry a toothbrush along with their pen or pencil, and use it whenever they indulge. We now have approved plumbing in schools, gasoline stations,

soda fountains, and public buildings, as well as in our homes. It follows that it is no longer necessary to wait three or four hours before brushing the teeth just to conform to an after-meal or bedtime routine. The adage that an ounce of prevention is worth a pound of cure was never more true.

When we, as members of the dental profession, have taught the public what we know concerning the prevention of dental caries, and later there is no significant reduction in the numerical intensity of carious lesions, then does not this preventable disease become evidence that the public has chosen to neglect the healing arts of dentistry rather than that dentistry itself has failed?

SUMMARY

Available dental knowledge and personnel must be combined to formulate a workable plan of caries control to suit the varying personalities of 150 million American people. Such a plan must be economical, simple, and understandable, both in content and execution.

There exists at the present time sufficient knowledge to formulate a simple plan to reduce the amount of dental decay.

The plan suggested in this paper used a three-legged milk stool to illustrate the three component parts of caries control. These parts are:

1. Reduction of refined carbohydrate intake.
2. Proper toothbrushing at indicated times.
3. Care in the dental office.

This plan is as simple as A B C.

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"ORTHODONTICS: QUESTIONS AND ANSWERS"*

The Council on Dental Health of the American Dental Association announces a new booklet entitled "Orthodontics: Questions and Answers."

The intent of the booklet is to answer some of the questions which parents commonly ask about conditions requiring orthodontic care.

In preparation of the text, it was submitted to a number of men in the field of orthodontics for their suggestions. Two committees of the American Association of Orthodontists, namely, the Public Relations Committee and the Committee on Public Health, were consulted on drafts of this material.

Sample copies of "Orthodontics: Questions and Answers" have been mailed to all diplomates of the American Board of Orthodontics, but have not been mailed to all members of the American Association of Orthodontists.

The Council on Dental Health uses several methods of acquainting dentists with the availability of new dental health education aids, that is, the A. D. S. News Letter, the Council News Letter, *The Journal of the American Dental Association*, and special mailings.

Inasmuch as this book is of particular interest to the specialty of orthodontics, Secretary Gruebel, of the Council on Dental Health, has given formal permission for the AMERICAN JOURNAL OF ORTHODONTICS to give publicity to this excellent compilation in booklet form.

Herewith follows the text of the booklet as prepared by the A. D. A.

H. C. P.

ORTHODONTICS: QUESTIONS AND ANSWERS

WHAT IS ORTHODONTICS?

ORTHODONTICS is the name applied to one division of the practice of dentistry. It has to do with the detection, study, prevention and correction of irregularities in tooth position and jaw relationship and deformities of the face produced by these conditions. The specialist who performs orthodontic diagnosis and treatment is called an orthodontist.

What is abnormal tooth arrangement commonly called?

The technical name for this condition is "malocclusion." This is the term applied to irregularities of tooth position and occlusion (the fitting together of the teeth on closing the jaws). Malocclusion or dental deformity may in turn lead to deformities of the jaws and face, otherwise known as facial deformity.

HEALTHY AND ATTRACTIVE TEETH AS AN ASSET

Why is a reasonably even row of well kept teeth important?

Healthy teeth in proper position are important from the standpoint of health of the mouth and the general personality, through both function and appearance.

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What are the evidences of dental and facial deformity which should cause the parent to seek competent advice?

Crowded, spaced, protruded or rotated teeth. Extra teeth or the failure of certain teeth to form. Early loss of primary (first) or permanent teeth. Protruding upper front teeth or a lower jaw that appears to be prominent, deficient or swung to one side. Overly prominent lips as a result of front teeth (upper and lower) that are too prominent. Front teeth that do not meet when the back teeth are closed or upper teeth that completely cover the lowers upon closure of the back teeth.

Can malocclusion be harmful to health?

Yes, irregularities may interfere with the highest efficiency in mastication (chewing). They also may prevent the individual from selection of the proper foods for adequate nutrition. Failure of the teeth to mesh properly produces an abnormal "bite." Teeth that are not in normal relation to each other may not grind food finely before it is swallowed. Dental and facial deformities often are a psychologic handicap. In later life, severe crowding of the teeth can be a factor in gum diseases, usually referred to as gingivitis or pyorrhea. They also may contribute to certain types of defective speech.

Is malocclusion a factor in diseases of the mouth?

Teeth that are not in correct position may offer an opportunity for added retention of food particles and debris. If the teeth overlap or are crowded, it may be difficult to keep them clean. Retention of food may prepare the way for tooth decay and lead to disease of the gums.

How are personal appearance and mental attitude affected by malocclusion?

A reasonably even row of well kept teeth is one of the prime essentials to good appearance. The teeth may be too conspicuous, or the lower jaw may protrude or recede too much. Such a condition detracts from the appearance and may produce a definite feeling of inferiority in some children and also in adults. A person's mental attitude and personal appearance can be altered.

PREVALENCE OF MALOCCLUSION

Are there many cases of deformity of the face or jaws, commonly known as malocclusion?

There are in the United states approximately 40,000,000 children less than 16 years of age. Of these, about 8,000,000 need major orthodontic care. One study indicated that some malocclusion is to be found in about 50 per cent of the population.

During what period in life is malocclusion most likely to be present?

Malocclusion probably is least likely to be present in the primary teeth. It is most common during the mixed dentition period (when the primary teeth are being shed and the permanent teeth are erupting) and then decreases again with eruption of all the permanent teeth. Actually malocclusion is likely to be noted at any age by those trained to detect it.

CAUSES OF MALOCCLUSION

What is the cause of malocclusion?

There are two general causes of irregular teeth, inherited and environmental or acquired. The nature of malocclusion is so complex that it is not possible to attribute the condition to one cause in the individual case. The dentist in his care of the child will give further information that will be of assistance.

What is the effect of habits?

Living bone is not hard and unyielding, as one might suppose. On the contrary, it can be molded by the application of pressure. Sucking habits, biting habits and improper posture during the waking hours may exert pressures that interfere with a good growth pattern.

Do certain sleeping positions cause malocclusion?

Although the specific cause of various types of malocclusion is not always easily determined, many dental authorities believe that malocclusion sometimes is caused by a sleeping posture which produces prolonged pressure to the jaws.

What are the ill effects of abnormal thumb or finger sucking, tongue thrusting or lip sucking?

Any of these habits brings abnormal pressures to bear on the teeth and delicate bones of the face, and they will do damage to the jaws if continued vigorously for any length of time. The pressure caused by the thumb, fingers, tongue or lip may produce changes that result in deformity. The result may be abnormal development of either or both jaws, open-bite deformities, and displacement of the teeth.

What is the cause of abnormal thumb or finger sucking?

A distinction must be made between normal and abnormal sucking, including thumb and finger sucking. Normal sucking is a part of the normal behavior pattern of the infant. Various explanations have been advanced for abnormal sucking, such as insufficient feeding, inadequate love for the child, a bored, unhappy or overfatigued child, or other emotional disturbance.

What causes extreme irregularity of the teeth?

Causes are usually so interrelated that it becomes impossible to single out one factor. Sometimes eruption of teeth is advanced further than growth of the jaws. If this situation exists, the size of the jaw is not adequate to accommodate the erupting teeth, and the teeth wedge themselves into place by twisting and overlapping. Thus, extreme irregularity of teeth is often a growth problem. If growth continues sufficiently, the teeth may align themselves in a satisfactory arrangement. Narrow dental arches owing to abnormal pressures or oversized teeth are also important causes of irregularity.

PREVENTION OR CORRECTION OF MALOCCLUSION

Can irregularities of the teeth and deformities of the jaws be prevented?

Yes, the dentist frequently can halt certain conditions in the mouth, such as those related to mouth habits, premature loss of teeth,

filling of teeth, preservation of space for teeth which will erupt later and extraction of primary teeth which have been retained past the time when they should have been shed.

When should preventive measures be started?

Preventive measures should be considered whenever a beginning deformity or the cause of one is discovered. A dentist should be consulted regarding the time when a preventive measure will be the most effective.

Can malocclusion be corrected?

Yes, orthodontic care can correct the irregularity of teeth. However, every patient presents individual complications which have a bearing on the results that can be obtained.

Why is it important to keep the primary teeth in healthy condition until they are shed?

Primary teeth maintain the shape of the dental arch and necessary space for eruption of the permanent teeth. In addition to the possibility of causing malocclusion, decayed primary teeth may become infected and abscessed.

What is the result of premature loss of the primary teeth?

When the primary teeth are lost too early, the adjoining teeth may shift, and thus the space intended for the permanent teeth is reduced.

If primary teeth are lost too soon, what should be done?

The space of the missing tooth should be watched by a dentist, and if it tends to close too much, a space maintainer should be used to maintain the space between the adjoining teeth.

What is the effect of prolonged retention of the primary teeth?

When the primary teeth are retained too long, the incoming permanent teeth may be prevented from arranging themselves properly.

If primary teeth are retained too long, what should be done?

X-ray examination will show the condition of the roots and the presence and progress of the permanent teeth. If the dentist finds that they are formed sufficiently to be ready to erupt, the primary teeth should be removed. He also will give advice concerning the need for the services of an orthodontist.

When does a child begin to form habits?

An infant begins to form habits, both good and bad, immediately after birth. Just as his growth is at its highest rate during infancy, so is his habit formation.

How can the habit of abnormal thumb or finger sucking be broken?

It is much better and often easier to prevent such undesirable habits than to attempt to break them. However, it usually is not necessary or desirable to correct thumb sucking during infancy. A dentist who specializes in the care of children's teeth or an orthodontist should be consulted about the methods for preventing and correcting thumb sucking if such measures become necessary.

FACTORS GOVERNING TREATMENT

At what age should orthodontic treatment be started?

The nature of the imperfection determines the age at which treatment should be started. Preventive measures may be applied at any time in the development of the child's occlusion. Only a person experienced in the development of children's dental arches can decide when treatment should be instituted. After the eruption of the primary teeth, when the child is 2 to 2½ years of age, he should be placed under the observation of a dentist, both for general dental care and for the early detection of possible irregularities. Regularly thereafter as growth continues, he should be examined by the dentist. If irregularity of the teeth develops at any age, a dental consultation should be arranged.

How long does orthodontic treatment require?

The length of the treatment depends on the condition. If the problem is only one of aligning teeth, a course of treatment covering twelve months or less may suffice. If, on the other hand, there is a growth problem, correction may take longer. In such a case, the orthodontist may divide the treatment into several stages, each stage aimed at bringing the growth up to the child's age. Such a program of orthodontic care can end only after all the teeth, including the second permanent molars, are in position.

What should be done about a space between the upper front teeth?

In many instances, this space is only a passing phase of growth; however, it should be observed by a dentist. There may be several causes of separation between the upper front teeth. Treatment should be recommended by a dentist after he has had an opportunity to diagnose the cause.

How does the orthodontist usually proceed in the treatment of malocclusion?

First, he makes a thorough examination of the patient and studies the patient's background and dental and medical history. He may make a plaster cast of the teeth, gums and jaws, take face measurements and obtain x-ray pictures to assist him in determining the exact nature of the abnormality. Since no two conditions are identical, treatment is adapted specifically to each patient. An effort is made to promote proper alignment and thus make satisfactory function possible.

Is the foregoing all there is to "straightening crooked teeth"?

Orthodontics also concerns itself with growth and development. Teeth are not just forced or pried into or out of position by the exertion of mechanical pressure. On the contrary, orthodontics is a highly specialized division of dentistry, and it requires a specific knowledge of many sciences in order to design and apply the proper corrective treatment.

Is it actually possible to change the formation of the bony structure of the jaw?

Yes, in that portion of the bone which holds the teeth. Maximum results cannot always be realized, but in most cases, if treatment is be-

gun early enough and regularly continued for a sufficient period, marked improvement in appearance results.

Will orthodontic appliances cause the teeth to decay or to become weakened?

No, teeth are just as firm and usually far more useful after orthodontic treatment than before.

What is the role of the patient in orthodontic treatment?

Cooperation of the patient is necessary for the best results in the wearing of corrective appliances and in the home care of the mouth In fact, in many cases, cooperation is the key to success. If the patient fails to cooperate, or if the parents fail to see that he does so, they might better save their money and the orthodontist's time, since the results of treatment probably will be unsatisfactory or discouraging. With conscientious cooperation between the patient and the dentist, orthodontic care yields high dividends in satisfaction, happiness and health.

Is it necessary for the parent to be present at all of the numerous appointments that are required for orthodontic treatment?

Presence of the parent (preferably both parents) is highly desirable at the first appointment when initial plans are being made. However, children are more cooperative when they can receive the orthodontist's undivided attention at all subsequent appointments. Moreover, the orthodontist can render much better service if spared the distraction of irrelevant conversation with a third party.

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Department of Orthodontic Abstracts and Reviews

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The Pediatrician's Responsibility in the Prevention of Dental Caries: By Gordon H. Rovelstad, D.D.S., M.S.D., *J. Pediat.* **36:** 687-696, June, 1950. (Original article reprinted as abstract with deletions.)

Parents are better educated regarding their children and physicians are better equipped to meet the medical problems that arise. Yet, dental disease of children seems to go on unchecked, seemingly involving more children and younger children today than a century ago. Estimates have been made that 98 per cent of all school children in the elementary grades have suffered the effects of this disease in varying degrees of severity. It is so common that frequently a desperate situation must arise that involves pain or an acute infection before some get concerned over it.

Many reasons might be given to account for this; however, six reasons of importance might be listed as follows:

1. Lack of parental knowledge and understanding of the importance of early dental care.
2. Lack of interest on the part of the dentist in the care of children, or the fear of a dentist of an unmanageable child.
3. Fear on the part of the child of the dentist as developed by adult conversations, cartoons, and jokes.
4. Lack of interest until recently on the part of the clinical dental practitioner in the study of children's problems and how to cope with them.
5. Lack of personnel in the dental profession.
6. Incomplete knowledge of the nature of dental disease.

* * * * *

Dental caries has been considered a mystery, unsolved except by theory, for years. Various schools of thought developed in various parts of the country. Each group felt that it was in disagreement with the others, whereas, in reality, they were quite close to the same idea. This was demonstrated in September, 1947, at the University of Michigan. At that time, more than one hundred dentists, physicians, biochemists, nutritionists, and dental health educators enrolled at Ann Arbor to attend a workshop on the evaluation of the caries problem, its prevention and control. One of the most important results of this meeting was the work of the committee that prepared and presented a definition and explanation of the process of dental caries as it is known today. This definition, which was prepared by analysis and study of the numerous accepted research studies that have been recorded in the literature and was based on a theory that was first advanced before 1900, has stood the test of time and has been greatly elaborated upon. The accuracy of this definition was emphasized by its unanimous acceptance by the entire group representing many different schools and research teams from over the country. Upon

this definition the whole of caries prevention and control and its complexity can be understood. Therefore, part of it is quoted as follows:

"Dental caries is a disease of the calcified tissue of the teeth. It is caused by acids resulting from the action of microorganisms on carbohydrate and characterized by a decalcification of the inorganic portion, and accompanied by, or followed by, a disintegration of the organic substance of the tooth. The lesions of the disease predominantly occur in particular areas of the tooth and their type is determined by the morphology of the tissue in which they appear.

"The acids involved in the carious process are derived from carbohydrate substrate after they have been acted upon by microbial enzymes. The enzymes have their origin from the microbial flora which has an enzyme system capable of breaking down carbohydrates to acids. Any microorganism or combination thereof, which is capable of maintaining an acid potential sufficient to decalcify enamel, is capable of initiating dental decay.

"The following microorganisms have been found capable of producing acid potential in vitro: Lactobacilli, aciduric streptococci, diphtheroids, yeasts, Staphylococci, and certain strains of sarcina. The lactobacilli have been the only microorganisms which have been found to show a significant increase in incidence with the initiation of caries. Lactic acid has been demonstrated to be present in the carious lesions by a specific method. Phosphoglyceric, pyruvic, formic, acetic, proprionic, and butyric acids have been demonstrated to be formed by microbial action in saliva sugar mixtures.

"Whether or not the acid formed will decalcify the enamel of the tooth is dependent upon: (1) the degree of acidity; there is good evidence to indicate that an acid potential in the vicinity of pH 5.0 is sufficient to decalcify the inorganic structure of a tooth, (2) the time that it is in contact with the tooth; the time that the acid must be in contact with the tooth in order to produce decalcification is not known.

"A suitable substrate and enzyme system are necessary for the production of acids. The preponderance of evidence indicates that the acids are formed by the presently accepted 'anaerobic phase' of carbohydrate degradation. We recognize that other paths of degradation are possible but as yet have not been demonstrated to occur in the mouth. The substrate is derived from ingested carbohydrate or carbohydrate from any other possible source. The enzyme systems are known to be derived from the microorganism, but they also may be derived from the oral tissues and secretions.

"The effect of the process on the tooth (carious lesion) is made possible by circumstances or structures which retain sufficient acid in contact with tooth substances. These include: (1) the dental plaque (an organic nitrogenous mass containing multitudes of microorganisms firmly adhering to the teeth), (2) anatomical characteristics of the teeth, (3) the position or arrangement of the teeth in the dental arch, (4) dental appliances. The above are not necessarily in their order of relative importance.

"There are also natural factors in the mouth which contribute to the dissipation of acids formed on the tooth surface such as: (1) the amount of saliva, and (2) the buffering capacity of the saliva. A few reports have suggested that resistance to dental caries in human beings may be accounted for by inhibitory substances. Until such time as more evidence is available to indicate the identification and action of these factors, it is necessary merely to recognize their possible role.

"The determining factor as to whether or not the carious lesion is developed depends upon the interrelationship of all the above variables, so that *no single factor may be construed as being the general cause of all dental caries. . . .*"[1]

* * * * *

Acid is formed within three minutes after the introduction of carbohydrates,[2] reaches a peak of formation within fifteen to twenty minutes, and remains for an hour or more. During this period, damage to the teeth may occur. After periodic repetitions of this process over a period of time, cavities develop and progressively enlarge. The simple sugars, monosaccharides, and disaccharides, are of most concern since they are most rapidly converted to acid under the conditions present in the mouth.[3] Starches are also to be considered inasmuch as the saliva contains an enzyme, ptyalin, capable of breaking starch down to a sugar. This is a slower process, however, and is only concerned in the caries process if starch foods remain in the mouth for a period of time.

Therefore, the amount and frequency of ingesting the carbohydrate substrate and the numerical presence of acid-forming bacteria will determine the rate at which these acids are produced.

Thus with this understanding of the carious process, we can realize that dental caries differs from any other bacterial infection affecting the human body in that it occurs within the oral cavity and outside of the bodily tissues that are capable of inflammatory reactions.

Several routes of attack can be considered in the control and prevention of this disease. One, of course, is the repair and restoration of the damaged part of the tooth while the lesion is small, thereby preventing its progression. Second, is the elimination or control of the carbohydrate foods responsible. Third, is the elimination of the carbohydrate foods from the mouth immediately after eating. Fourth, is the neutralization of the acids as soon as they are formed. Fifth, is the elimination or reduction in the mouth of the microorganisms responsible for the acid formation. Sixth, is the inhibition of one or more phases of the chemical reaction involved in the formation of acid from carbohydrates. Seventh, is the development of a surface tooth structure that is more resistant to acids. Eighth, is the treatment of faults in the tooth structure so that these weak spots are less permeable to the penetration of microorganisms or acids.

* * * * *

Restoration of damaged tooth structure is the only sure way of treating a cavity that has already formed. If the restoration is complete and all carious tooth structure is eliminated as taught by Dr. G. V. Black at the turn of the century, there is reasonable assurance that the lesion will not progress. Complete restoration of all carious lesions is therefore the first step in the control of dental caries for the child patient. Historically speaking, dentistry is now in the restorative period and the remaining preventive methods are now being developed for widespread use in the practice of the future.

The elimination of the substrate (carbohydrate foods, especially refined sugars) in the diet is the basic principle for preventing the initial carious lesion. Herein some interesting figures from the Department of Agriculture give us an insight into why dental caries has become an increasingly widespread disease of children.

The consumption of free sugar has increased in the United States from 17 pounds per person a year in 1824 to approximately 95 pounds per person in 1948. The total consumption of sugar has increased since 1823 from a few thousand tons to more than 500,000 tons. In 1927, the total consumption of candy was 1,733,000,000 pounds or a per capita of 14.7 pounds. In 1943, the total consumption was 2,561,000,000 pounds or a per capita of 19.0 pounds which was sold for a total of 336 million dollars. However, candy alone is not the only problem. There are many foods and confections available that are as rich in refined sugar as candy or richer. Some of these are soft drinks, canned fruits, pastries, and many others.

However, the amount of sugar in each item is not as important as is the time and method of consumption, and how much remains in the mouth. If sugars are consumed only at mealtime together with a well-balanced and adequate diet, there will be a greater elimination and dilution by the other foods, saliva, and the act of mastication. On the other hand, if a small amount of sugar is consumed regularly between meals such as may be obtained from cough drops, chewing gum, cookies, raisins, cough syrups, or soft drinks, there is a greater possibility of localized acid formation without disturbance.

* * * * *

Sugar consumption is vicious in that it was developed into a great habit for American children, that of eating, drinking, sucking, or chewing on something almost continuously between meals. The delicacies most readily available and most highly advertised, of course, contain sugar in varying amounts and are most often given to children by kindly adults who have no regard for regular eating habits.

Another fact to be considered is the more extensive use of canned fruit and fruit juices in substitution for fresh fruit which provide an added source of sugar. All of these serve to cultivate an artificial appetite and craving for sugar by the child which, once started, is difficult to break. Trained nutritionists will tell you that an adequate diet may be planned without *refined* carbohydrate and still maintain a high daily calorie intake. Therefore, with this in mind, our interest in caries prevention becomes more intensely focused on dietary control, and depends more upon parental education.

Elimination of the substrate from the mouth immediately after its introduction is centered around oral hygiene. By brushing the teeth immediately after the consumption of concentrated sugars and starches, a great deal may be accomplished in the prevention of the initial lesions of caries.[3] Or, if this is not possible, the practice of rinsing the mouth with water at this time by forcing the water between the teeth with the tongue and cheeks is a good hygienic measure. The effectiveness of this method of caries prevention depends again upon the time and thoroughness of the oral hygiene. Certainly the mouth should be thoroughly brushed after each meal and after the eating of sugar foods and before retiring at night, provided that nothing is eaten afterward. For most children, oral hygiene is not very adequately carried out, but the habits should be developed at that time. Parents should be instructed to brush the young child's teeth regularly. A proper technique should be taught that is simple and yet reaches every possible space where food might lodge.

Neutralization of the acids as soon as they are formed is a means of caries prevention provided by nature.[3] The saliva is normally alkaline and very highly buffered. * * * * * In an effort to increase the buffering capacity of the saliva, a greater amount of fresh fruit and green vegetables should be consumed daily. These foods also provide a good cleansing action during mastication.

* * * * *

One method of reducing acid-forming bacteria in the mouth has been given a great deal of publicity recently and has taken the country by storm—that is, the ammonium ion dentifrice. It has been demonstrated to be very effective in the matter of reducing oral bacteria,[5] but has not yet been proved actually to reduce the incidence of dental caries, or to be more effective in this than an ordinary dentifrice when used after meals.

* * * * *

Recent reports on the use of chlorophyl[6] in caries prevention are even more in their infancy, but act in the same manner by reducing the numbers of microorganisms in the mouth.

Interference with the mechanism of sugar reduction to acid is a method that may provide a measure of caries control in the future. One study reported the use of vitamin K in this capacity.[7]

* * * * *

The topical application of sodium fluoride and the introduction of optimum amounts of fluorine in the public drinking water attempt to prevent caries by means of developing a surface enamel that is more capable of resisting dissolution by acid. It has been known for a long time that there is an inverse relationship of the incidence of dental caries to the amount of fluorine in the public water supply.[8] The optimum amount of fluorine for caries prevention without danger of dental fluorosis (mottling of the teeth) is one part per million.

* * * * *

The last method of caries prevention involves the use of certain drugs, such as silver nitrate and zinc chloride to block uncalcified faults in enamel to prevent the ingress of acids or microorganisms into dentin and thereby make the tooth more resistant to dental caries.[9] This also is a very immature phase of caries prevention that may or may not have future possibility, although it has been given several big write-ups in national magazines as an effective caries prevention treatment. The studies that have been reported to date on this are inconclusive and must be continued before any information of value can be released.

Several practical methods of caries prevention and maintenance of oral health may be set down that apply to every child patient in the form of daily rules.

These are:

1. Reduce the total daily intake of refined sugars and soft starches.
2. Eliminate daily between-meal and before-bed snacks of foods containing refined sugars or starches.
3. Increase the daily intake of rough foods, fresh fruits, and green vegetables.
4. Practice oral hygiene measures after every meal—either thoroughly brushing the teeth or rinsing the mouth with water.
5. Use an ammonium ion dentifrice. It costs little more than a regular dentifrice, does the same job, and may be proved to be of value in caries prevention in the near future.
6. Accept the topical application of sodium fluoride as a possible aid that may be of value and apparently can do no harm.
7. Last, and probably the only approach a dentist can control, have all cavities already developed restored when they are small, deciduous and permanent teeth alike. A regular and periodic visit to the dentist is required for this, and the number of new cavities developed each year will vary with the degree of cooperation obtained in the first four rules.

All of these rules apply to parents, children, and dentists. There is also a set of suggestions that a pediatrician or family physician can present for patients which will help form the basis for a good prevention program.

These are as follows:

1. Avoid endorsing lollypops, chewing gum, or confections in general by giving them out to children as rewards at the end of an appointment. This may break down all the control that a parent has with a child in avoiding these habits as well as to put the dentist in an embarrassing position.
2. Avoid the use of medictions or dietary supplements, when possible, containing sugar, syrup, or honey as vehicles. This is especially important when

they are to be used repeatedly over long periods of time, even if individual amounts are small.

3. Avoid indiscriminate recommendations of between-meal eating of sugar foods when possible to do otherwise.

4. Control diets of long-hospitalized patients so that they are low in refined sugars and soft, mushy starches and high in fresh fruit and green vegetables in addition to being well balanced.

5. Instruct nurses to provide oral hygiene measures after meals for hospitalized cases.

6. Instruct parents to take their children to see a dentist interested in children and preventive dentistry as early as 2½ years of age.

7. Recognize when children are getting proper dental care and consult with the dentist involved when question arises.

8. Instruct parents early as to what factors are involved in dental caries and dental disease and what measures they should take to prevent it. This should be well understood by parents when the child is one year of age.

9. Aid the dentist when asked in the planning of a diet for a patient of extreme susceptibility that meets the above requirements.

* * * * *

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News and Notes

American Association of Orthodontists

E. Bach.

Old-Timers' table at the international luncheon at the meeting of the American Association of Orthodontists, May 9, 1950. Left to right, James D. McCoy, Los Angeles; Leuman M. Waugh, New York; John V. Mershon, Philadelphia; Benno E. Lischer, St. Louis; Fred Noyes, Chicago; Ollie W. White, Detroit; Jake Gorman, New Orleans.

Changes in the Bylaws of the American Association of Orthodontists

Below are transcribed verbatim the changes in the bylaws which were passed at the 1950 annual session of the American Association of Orthodontists:

Chapter I, Section 2

(A) A person who has been an associate member in a Constituent Society of the American Association of Orthodontists for one year and who is a member in good standing in his local, state, and national dental organizations may be elected to active membership through the Constituent Society, provided the applicant has:

1. Three years of specialization, including one full-time year of university graduate or postgraduate orthodontic training with recommendation by two active members; or
2. Three years of specialization, including two years preceptorship or an equivalent which must satisfy the committee which passes on applications, with recommendation by two active members; or
3. Four years of specialization, including informal training by preceptors, suitable short courses or seminars which satisfy the committee which passes on applications, with recommendation by two active members.

(C) Active members shall remain in the exclusive practice of orthodontics or forfeit membership in the organization, except that an active member retiring from practice may, if he desires, retain his active membership by paying full dues.

Chapter I, Section 7

A member discontinuing practice may be placed on the retired membership list as provided in Chapter I, Section 16, or may be elected to honorary membership as hereinafter provided.

Chapter I, Section 15

Affiliated members shall be members in good standing of recognized foreign dental organizations. Affiliated members may be elected by the Association upon recommendation of the Interrelations Committee. They shall have all the privileges of the Association, except voting and holding office, and shall be exempt from the payment of dues, but shall pay for the official publication of the Association if they desire it.

Chapter I, Section 16

Retired members shall consist of members who have retired from active practice of orthodontics and who have been placed on retired membership by action of the Constituent Society whose Secretary shall notify the Association of this action. They shall be exempt from dues and assessments but may receive the official publication by paying cost of same.

Chapter IV, Section 1

There shall be the following standing committees:

Ad Interim
Budget
Program
Local Arrangements
Publication and Editorial Board
Public Relations
Education
Research
Judicial Council
Nomenclature
Constitution and Bylaws
Relief
Interrelations
Necrology
Laws and Infractions
Military Affairs
Public Health

Chapter V, Section 5

The Publication and Editorial Board shall consist of the Secretary-Treasurer and three other members, and be maintained at a membership of four by the Association in the following manner: At each annual session one member only shall be elected to serve for a term of three years. The President shall appoint the Chairman of this Board.

The Board shall arrange to supply the official JOURNAL of the Association to all members in good standing.

It shall arrange for the publication of the transactions of the Association at the direction of the Board of Directors.

It shall have full power to cut down, amend, or omit such matters as it may deem proper, in the preparation of the transactions for publication. All papers read before the Association shall become its exclusive property.

It shall cause to be printed at the beginning of each volume of the transactions the following disclaimer: "The American Association of Orthodontists, although accepting and publishing the reports of the various committees and the papers read before it, is not responsible for the opinions, theories, or criticisms therein contained except where otherwise decided by special resolutions of the Association." The Chairman shall make an annual written report to the Association.

Chapter V, Section 13

The Committee on Interrelations shall consist of three members, and be maintained at a membership of three by the President in the following manner: At each annual session, one member only shall be appointed for a term of three years.

The President shall appoint the Chairman of this Committee.
The Committee shall cooperate with the officers of the next scheduled International Orthodontic Congress in such matters as may be delegated to it by the Board of Directors.
The Committee shall pass upon applications for affiliated membership as provided in Chapter I, Section 15.
The Chairman shall make an annual written report to the Association.

Chapter V is amended by redesignating the present Section 16, Section 18; the present Section 17, Section 19; and inserting new Sections 16 and 17.

Chapter V, Section 16

The Military Affairs Committee shall consist of five members, with terms of office of one, two, three, four, and five years. Beginning with the next annual session, one member shall be elected annually for a term of five years.
The Committee shall organize by electing its own chairman.
The duties of the committee shall be to review and study the specific problems of the various governmental dental corps; to formulate plans that will increase the efficiency of said corps; to submit such plans to the Board of Directors; and to cooperate with like agencies in the American Dental Association in the Common interest of the profession and the public.

Chapter V, Section 17

The Public Health Committee shall consist of five members with terms of office of one, two, three, four, and five years. Beginning with the next annual session one member shall be elected annually for a term of five years.
The Committee shall organize by electing its own chairman.
The duties of the committee shall be to conduct studies of the orthodontic needs of the public; to plan to meet such needs; to formulate programs for promoting orthodontic care; to submit such plans to the Board of Directors; and to act as a liaison with other agencies interested in the promotion of programs for improvement in orthodontic care.

Chapter VII, Section 3

There shall be a Nominating Committee consisting of the seven elected Directors of the Constituent Societies or their Alternates and the President of the American Association of Orthodontists.
The President shall be the presiding officer of the committee. He shall have the power to vote only in the event of a tie.
This Committee shall present nominations for the office of President-Elect, Vice-President, and Secretary-Treasurer.
The Committee shall present such nominations at the business meeting of the annual session immediately following the scientific program on the afternoon of the second day. Other nominations may be made from the floor.

Chapter VIII, Section 1

(B) 1. Budget
2. Publication
3. Public Relations
4. Education
5. Research
6. Judicial Council
7. Constitution and Bylaws
8. Relief
9. Laws and Infractions
10. Military Affairs
11. Public Health

Chapter XIV has a new Section 8 which reads as follows:

> The minimum standards of eligibility for associate membership in the Constituent Societies shall be:
>
> 1. One year of university graduate or postgraduate orthodontic training; or
> 2. One full calendar year of preceptorship with an active member; or
> 3. In exceptional cases a combination of the above two may include orthodontic training from informal courses. The combination must satisfy the committee which passes on applications. The applicant must be recommended by two active members of the Constituent Society to which he applies; or
> 4. Two years full-time specialization including orthodontic training from informal courses, preceptorships, or seminars. These sources of training must satisfy the committee which passes on applications, recommendation to be by two active members of the Constituent Society to which the applicant applies.

Chapter XIV, Sections 8, 9, 10, 11, and 12 are renumbered as Sections 9, 10, 11, 12, and 13, respectively.

American Board of Orthodontics

The secretary of the American Board of Orthodontics advises the JOURNAL that the final paragraph in the 1950 minutes of the American Board contains the statement below. This paragraph will be of great interest, particularly to all orthodontists who have watched the heroic efforts being made by few to establish the specialty of orthodontics on as high a plane as is demanded in the various specialties of medicine.

> "Upon the retirement of its President, James D. McCoy, his fellow directors on the American Board of Orthodontics wish to acknowledge his accomplishments and contributions as a Board member during his nine years of service, and desire to have recorded in the Minutes their deep appreciation of his sterling qualities and sincere devotion to the advancement of orthodontics and humanity."

Central Section of the American Association of Orthodontists

The 1950 meeting of the Central Section of the American Association of Orthodontists will be held November 26, 27, and 28 at Cedar Rapids, Iowa.

Northeastern Society of Orthodontists

The fall meeting of the Northeastern Society of Orthodontists will be held at the Shoreham Hotel, Washington, D. C., Nov. 6 and 7, 1950.

Southern Society of Orthodontists

The twenty-sixth annual meeting of the Southern Society of Orthodontists will be held at the Sherry Frontenac Hotel, Greater Miami, Florida, Nov. 15, 16, and 17, 1950. Extensive plans and preparations are being made for this meeting. It will be held under the direction of President E. C. Lunsford, of Miami.

FRANK P. BOWYER, Secretary.

Southwestern Society of Orthodontists

The next meeting of the Southwestern Society of Orthodontists will be held Oct. 15, 16, 17, and 18, 1950, at Hotel Frances, Monroe, La.

The Tentative Program of the Twenty-first Annual Meeting of the Great Lakes Society of Orthodontists, Hotel Statler, Detroit, Mich., Nov. 19, 20, 21, and 22, 1950

MONDAY MORNING, NOVEMBER 20

8:00 to 9:00 A.M. Registration. Oak Foyer.

9:00 A.M. Exhibits. Parlor C, D, and E.

10:00 A.M. Business Meeting. Michigan Room.

11:00 A.M. Dr. Allan Brodie, University of Illinois. A Résumé of Diagnostic Procedures Appraised in Terms of Modern Knowledge. Michigan Room.

12:15 P.M. Past Presidents Luncheon. Parlor B.

MONDAY AFTERNOON

2:00 P.M. Dr. Robert E. Moyers, University of Toronto. Various Anatomical Landmarks Seen in Cephalometric Radiograms, and the Planes and Angles Used in Standards of Study. Michigan Room.

3:00 P.M. Dr. L. Bodine Higley, University of Iowa. Application of Cephalometric Appraisals to Orthodontic Diagnosis and Treatment. Michigan Room.

4:00 P.M. Dr. B. Holly Broadbent, Balton Foundation, Cleveland, Ohio. Practical Summary of Cephalometrics. Michigan Room.

MONDAY EVENING

This period is left open for random sociability and discussion.

TUESDAY MORNING, NOVEMBER 21

8:00 A.M. Breakfast for Clinicians and Committeemen. Parlor B.

9:00 A.M. Table Clinics. English Room.

11:00 A.M. Business Meeting. Michigan Room.

12:15 P.M. Great Lakes Luncheon. Ballroom.

TUESDAY AFTERNOON

2:00 P.M. Dr. Clare K. Madden, Columbia University. Treatment by Twin Arch Technique of Cases in Class II, Division 1 Tooth Relationship Involving Removal of Your First Premolars. Michigan Room.

3:00 P.M. Dr. Paul D. Lewis, Seattle, Wash. Treatment by Edgewise Technique of Cases in Class II, Division 1 Tooth Relationship Involving Removal of Four First Premolars. Michigan Room.

TUESDAY EVENING

6:30 P.M. President's Reception. Bagley Room.

7:00 P.M. Banquet—Informal. Wayne Room.

WEDNESDAY MORNING, NOVEMBER 22

9:00 A.M. Dr. William H. Oliver, Nashville, Tenn. Treatment by Labiolingual Technique of Cases in Class II, Division 1 Tooth Relationship Involving Removal of Four Premolars. Michigan Room.

10:00 A.M. Dr. John R. Thompson, Northwestern University. Oral and Environmental Factors as Etiological Factors in Malocclusion of the Teeth. Michigan Room.

11:00 A.M. Summary of Meeting by Dr. George Moore, University of Michigan. Michigan Room.

11:30 A.M. Installation of Officers and Adjournment.

Northern Section, Pacific Coast Society of Orthodontists

The Northern Section of the Pacific Coast Society of Orthodontists held its spring meeting at the University of Washington Dental School, Monday, June 5, 1950.

Sunday evening about 60 members and guests, with their wives, attended a cocktail hour followed by a dinner at the Rainier Club. Bill McGovern was toastmaster; he inveigled Ernie Jones, Dean of the University of Oregon Dental School, and Wendell Wylie, Director of Postgraduate Dental Education of the University of Washington, to say a few words informally. They responded with their usual wit and thought-provoking remarks:

The Scientific program consisted of the following:

Donald MacEwan. A clinic and discussion of "An Analysis of the Cross-Bite Problem."

Robert Nelson of the University of Washington Dental School:

"Properties and Mixing of Dental Cements" (which could well be given before every orthodontic group).

Résumé of theses prepared for Masters' Degrees by the following students in the Postgraduate School of Orthodontics, University of Washington School of Dentistry:

Warren Kenneth Orman. "An Evaluation of the Types and Degree of Orthodontic Tooth Movement Achieved Through the Use of a Maxillary Removable Appliance."

William Shigeru Takano. "A Study of Variations in Facial Relationships in the Adult Nisei With Excellent Occlusions."

Kenneth Samuel Kahn. "A Study of the Controllable Variants in the Production of Acceptable Human Head Radiographs and a Proposed Method for Their Control."

William Arthur Gilmore. "Facial Morphology With Special Reference to the Mandible of Adults With Class II, Division 1 Malocclusion as Compared With That of Adults Possessing Excellent Occlusion."

Emery Fraser. "Orthodontic Aims and Objectives."

Alton Moore, Professor of Orthodontics, University of Washington. "Functional Analysis of Malocclusion."

Allen Bishop. Discussed movie taken by Dr. Howard Lang, Dr. Merton Hill, and Dr. John Wilson entitled "Technique of Taking Full Mouth Impressions."

The following members and guests were in attendance: W. P. McGovern, J. M. Laughridge, E. A. Bishop, James M. Keenan, R. Crossley, H. C. Dahl, Howard J. Hammond, William Taylor, E. W. Tucker, Kenneth M. Walley, C. H. Walrath, Percy Rumball, George Parker, Milton Yellen, Paul Lewis, G. N. Dohner, E. S. Weyer, Robert L. Lande, Dick Cline, Emery Fraser, Kenneth D. Kahn, R. A. Philbrick, George R. McCulloch, W. K. Orman, William Dinham, Guy A. Woods, William A. Gilmore, W. S. Takano, Hal Noyes, R. A. Riedel, D. Lloyd Chapman, R. O. Gothenquist, B. J. Petraitis, Arnold E. Stoller, Gilbert H. Miller, John Van Houten, E. B. Faxon, George I. Hill, Wendell Wylie, Ralph G. Cooper, T. L. Hice, Ernest M. Jones, Denton J. Rees, H. N. Moore, Robert Nelson, J. E. Richmond, Robert DeButts, and Sayers J. Boyd.

E. Allen Bishop,
Secretary-Treasurer.

Central Section, Pacific Coast Society of Orthodontists

The Central Section of the Pacific Coast Society of Orthodontists held its last quarterly meeting at the Alexander Hamilton Hotel, Tuesday, June 13, 1950.

Members present were: Ray A. Lussier, Arthur Skaife, Ernest Johnson, Howard Dunn, Reid Van Noate, Fred E. Havrilla, Walter J. Straub, Harry Carlson, George B. Lemon, James R. Seaman, Ben Matzen, Verne V. Smith, Cecil Rand, Jack Loughridge, C. Konigsberg, Carl Engstrom, Kenneth Dufour, Howard H. Jan, Ray Curtner, Arthur Corbett, Jack McMath, Fred T. West, Raymond E. Brownell, Thos. R. Sweet, and Thomas E. Lewis.

Guests present were: F. W. Heitman, Geo. Merchant, Eugene E. West, Lloyd M. Cox, W. S. Parker, Ned H. Anderson, Peter J. Ceremello, John H. Adams, Phillip Konigsberg, and R. F. Ramsey.

In the afternoon, Program Chairman Charles Konigsberg presented Arthur J. Corbett of San Mateo, who lectured on the subject, "The Influence of Hereditary Characteristics on the Development of Individual's Personality."

The afternoon was devoted to the outlining of hereditary traits.

The evening session was called to order at 8:10 P.M. by Chairman Ray Lussier.

The minutes of the previous meeting were accepted as published in the *Bulletin*.

Acting secretary Charles Konigsberg read an application for membership of John H. Adams.

As there was no further business, the meeting was turned over to Program Chairman Charles Konigsberg, who ran through the color movie of a quick trip to the A. A. O. convention recently held in Chicago. This led to an enlightening report on that meeting by Ernest Johnson. This was followed by a short fluoroscopic movie, the work of Wendell Wylie, showing the movements of the mandible, narrated by Ernest Johnson.

Arthur Corbett was reintroduced and proceeded to give the second portion of his delightful presentation of his educational as well as entertaining subject. He was duly thanked for his presentation and the meeting was adjourned at 10:30 P.M.

ROY C. COWDEN,
Secretary-Treasurer.

Southern Section, Pacific Coast Society of Orthodontists

The Southern Section of the Pacific Coast Society of Orthodontists held its regular quarterly meeting at the Rodger Young Auditorium, 935 West Washington Boulevard, Los Angeles, on Friday, June 9, 1950. Since Harry Faulkner was absent because of illness, Merle Davis acted as chairman and introduced the Chairman of the Day, R. Paul Huster.

Paul presented a technical motion picture entitled, "The Management of Stainless Steel." This picture was shown at one of the five registered clinics at the Chicago meeting in May. The picture demonstrated how to overcome weaknesses of stainless steel which were found in early clinical experiences.

Sydney Cross reviewed the high lights of the Chicago meeting. He gave a comprehensive résumé of the clinics and the papers that were read. C. Stenson Dillon commented on the activities of the executive committee in Chicago.

A business meeting followed. Earl R. Crane, of San Bernardino, Calif., and J. Frederick Conrad, of San Diego, Calif., were elected unanimously to membership. The minutes of the last meeting were approved as published. John Hopkins announced that Chairman Faulkner had appointed James David McCoy to be Chairman of the Admissions Committee, with John Abel and Alfred Higson as his assistants. Vernon Fluhrer was appointed reporter for the Southern Section. A resolution by John McCoy was introduced and passed to request that the 1952 meeting of the American Association of Orthodontists be held in San Francisco.

The Secretary was directed to send copies of the resolution to the President, the President-Elect, and to the Secretary of the American Association of Orthodontists; and to the Secretaries of the Central and Northern Sections of the Pacific Coast Society of Orthodontists.

It was suggested that the Council for Dental Health in Los Angeles County investigate the report of the existence of an insurance policy for orthodontic treatment. The business meeting was adjourned for the social hour and dinner.

The first speaker of the evening was Dr. Marian Firor, child psychiatrist, who spoke on "Children's Emotions in Relation to Orthodontics." She was followed by Dr. John Moriarty, psychiatrist, who spoke on "Emotional Factors in Malnutrition." He is very active in the American Academy of Applied Nutrition. Lively discussion followed these interesting talks.

Members present were: C. Alderson, R. D. Andrews, W. Mahlon Adams, Bernice L. Barkelew, W. W. Bedford, S. Cross, M. B. Davis, C. F. S. Dillon, D. L. England, F. W. Fahrney, Eugene Farber, V. Fluhrer, R. J. Gawley, G. Gould, A. Grey, A. C. Heimlich, A. F. Heimlich, John Hopkins, Paul Husted, J. W. January, E. M. Johnston, C. S. Kaps, R. L. Keedy, Howard Lang, R. A. Lee, T. S. Martin, J. R. McCoy, H. V. Muchnic, G. Nagamoto, B. L. Reese, L. R. Sattler, C. E. Thompson, and R. L. Whitney.

Guests present were: J. V. Avakian, W. G. Brown, E. L. Corlett, L. L. Cottingham, W. C. Dorsett, Jr., B. L. Fletcher, R. S. Hambleton, Phillip Klein, C. L. Vollmer, and J. C. Wilcox.

JOHN HOPKINS, Secretary.

President Dillon has appointed Dr. Vernon L. Hunt, 707 Eye Street, Eureka, Calif., and Dr. Wendell L. Wylie, School of Dentistry, University of Washington, Seattle 1, Wash., to the Education and Research Committee to fill the vacancies due to the passing of Dr. Will G. Sheffer and Dr. P. T. Meaney.

Denver Summer Seminar

The thirteenth Denver Summer Seminar for the advanced study of orthodontics will be held at the Park Lane Hotel, Denver, Colo., July 30–Aug. 4, 1950.

The following is the schedule:

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
9:00-10:30	Wylie	Wylie	Brusse	Wylie	Cheney
10:45-12:15	Horwedel	Cheney	Announced later	Bell	Wylie
1:30-3:00	Cheney	Cheney	Bell	Announced later	Bell

Northwestern University Dental School

The Northwestern University Dental School held a postgraduate course on cephalometric radiography June 26, 27, 28, 1950, at Thorne Hall, Superior Street and Lake Shore Drive, Chicago.

The program was as follows:

The Lateral Cephalometric Radiograph as an Aid to the Orthodontist in Case Analysis and Treatment Planning. Waldo O. Urban, Northwestern University.

History of Cephalometry. Robert W. Donovan, Northwestern University.

Technique and Terminology. T. M. Graber, Northwestern University.

Basic Research for the Evaluation of the Skeletal Pattern by Cephalometric Radiography. Evaluation of the Facial Profile. Richard A. Riedel, University of Washington.

Cephalometric Appraisal of Malocclusion. William B. Downs, University of Illinois.

Cephalometric Appraisal of Malocclusion. John R. Thompson, Northwestern University.

Cephalometric Analysis of Treated Cases. William B. Downs.

Cephalometric Analysis of Treated Cases. Application of Cephalometric Radiography to Functional Analysis of Malocclusion. John R. Thompson.

Seventh Annual Seminar for the Study and Practice of Dental Medicine

Results of a two-year study of dental decay control utilizing an ammoniated dentifrice, the role of the dentist in the cancer problem, and radiation therapy related to dental medicine are some of the current findings that will be studied at the Seventh Annual Seminar for the Study and Practice of Dental Medicine at Palm Springs, Calif., Oct. 15-20, 1950.

Dr. Hermann Becks, president of the annual seminar, announced the subjects to be covered as follows:

The Conduct and Results of a Two-Year Caries Control Study Utilizing Oral Hygiene and an Ammoniated Dentifrice. Robert G. Kesel, University of Illinois.

Antibiotics. James M. Dille, University of Washington School of Medicine. Dr. Dille will also deliver a paper on analgesics.

Pathology of Periapical Infections. Differential Diagnosis of the Lesions of the Cheeks, Tongue, and Palate, and the Role of the Dentist in the Cancer Problem. Hamilton B. G. Robinson, Ohio State University.

Physiological and Therapeutic Aspects of Peptic Ulcer. Gastrointestinal Hormones and the Production of Arteriosclerosis by Dietary Maladjustment. Andrew C. Ivy, University of Illinois.

Radiation Therapy and Dental Medicine. B. V. A. Low-Beer, University of California.

Physiology of the Endocrine Glands. Clinical Applications of Compound E and ACTH and Use and Misuses of Sex Hormones. Willard O. Thompson, University of Illinois. Dr. Ivy will also discuss "The Nazi War Crimes of a Medical Nature."

Registration information and details of application may be secured by writing Miss Marion G. Lewis, Executive Secretary, Room 200, Hooper Foundation, University of California Medical Center, San Francisco 22, California.

Federal Security Agency, Children's Bureau and Public Health Service

According to Federal Security Agency, Children's Bureau and Public Health Service, some 100,000 children in the United States 10 years of age or less have undiscovered syphilis which they have had from birth, despite the big advances recently in the prevention and treatment of the disease. This is reported by two doctors in an article in the current issue of *The Child,* monthly periodical of the Children's Bureau, Federal Security Agency.

Technically called congenital syphilis, a better name for this disease would be "negligent" syphilis, say the authors, Dr. Betty Huse of the Children's Bureau, and Dr. W. H. Aufranc of the Public Health Service. Negligence, they point out, is the only reason for any child in this country to be born with the disease.

"Any one of these children is a candidate for blindness, mental deficiency, physical deformity, or premature death. Not one of them should have been born with syphilis. This is especially so now since penicillin, so effective in the treatment of the disease, has been widely available in recent years," the doctors say.

"We therefore propose joint action by the venereal-disease and maternal and child health programs to find and treat every syphilitic pregnant woman and to find and treat every syphilitic baby."

The doctors recommend two blood tests for syphilis for every pregnant woman, one early in pregnancy and the other in the last three months. Since syphilitic pregnant women are medical emergencies, they should receive treatment at once. Health departments provide care for patients who cannot be treated by private physicians.

For all babies born of syphilitic mothers, the doctors recommend that blood tests be made at birth. All such babies should be observed for four months, even when early tests do not show syphilis is present.

In an accompanying editorial in the same issue of *The Child*, Katharine F. Lenroot, Chief of the Children's Bureau, points out that the rate of acquired syphilis in the United States has been cut in half during the past four years while the rate of congenital syphilis has remained almost constant.

"With penicillin and proper prenatal care," Miss Lenroot says, "it is possible to prevent congenital syphilis in almost 100 per cent of children. All who work with children or with mothers can contribute greatly if they arm themselves with the knowledge of the human cost of this controllable disease and dedicate themselves not only to find the mothers and children who need treatment, but to help them get the treatment they need."

Italian Convention on Stomatology

The twenty-fifth annual Italian Convention on Stomatology promoted by the A.M.D.I. (Italian Medico-Dental Association), affiliated society to the F.D.I., will be held from Sept. 26 to 30, 1950, at Stresa (Lake Maggiore).

Pan American Odontological Association

A Plan for a Prize Essay Contest Among Undergraduate Dental Students

The Pan American Odontological Association announces a prize essay contest in 1950 among undergraduate students in the dental schools in North, Central, and South America. Each essay should be a discussion of ways to establish better Pan American relations in the dental profession, on a subject (title) to be selected by the author. An *award of one hundred dollars* will be paid to the author of the essay adjudged to be the most useful. That essay will be published in dental journals, after its presentation at the annual meeting of the Pan American Odontological Association in December, 1950. Each essay may be written in its author's mother tongue, under an assumed name, and presented to the Dean of the Dental School for transmission to *Dr. J. A. Salzmann, 654 Madison Avenue, New York, 21, N. Y.*, for receipt by him on or before *Sept. 30, 1950*. After selection of the prize essay, the Dean of the school to which the essay is accredited will be requested to identify the author for payment to him of the award.

J. A. Salzmann, Chairman,
William J. Gies,
Harry M. Seldin,
Committee on Prize Essay Contest.

Notes of Interest

Louis J. Williams, D.D.S., announces the opening of his office on Aug. 25, 1950, at 843 South Center St., Casper, Wyo., practice limited to orthodontics.

Bruce T. Mathias, D.D.S., M.S., announces the opening of his office at 218 Pine St., Harrisburg, Pa., practice limited to orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES

The AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

American Association of Orthodontists

President, Joseph E. Johnson - - - - - - - - - - - - - Starks Bldg., Louisville, Ky.
President-Elect, Bernard G. deVries - - - - - - - Medical Arts Bldg., Minneapolis, Minn.
Vice-President, Homer B. Robison - - - - - - - - - - - Wiley Bldg., Hutchinson, Kan.
Secretary-Treasurer, George R. Moore - - - - - - 919 Oakland Ave., Ann Arbor, Mich.

Central Section of the American Association of Orthodontists

President, L. B. Higley - - - - - - - - - - - - - - 705 Summit St., Iowa City, Iowa
Secretary-Treasurer, Earl E. Shepard - - - - - - - - 4500 Olive St., St. Louis, Mo.

Great Lakes Society of Orthodontists

President, C. Edward Martinek - - - - - - - - - - - - Fisher Bldg., Detroit, Mich.
Secretary-Treasurer, Scott T. Holmes, 509 Hackley Union National Bank Bldg., Muskegon, Mich.

Northeastern Society of Orthodontists

President, Richard Lowy - - - - - - - - - - - - - - 302 Main St., Chatham, N. J.
Secretary-Treasurer, Oscar Jacobson - - - - - - - - - 35 W. 81st St., New York, N. Y.

Pacific Coast Society of Orthodontists

President, C. F. S. Dillon - - - - - - - - - - - - - Taft Bldg., Hollywood, Calif.
Secretary-Treasurer, Frederick T. West - - - - - - 870 Market St., San Francisco, Calif.

Rocky Mountain Society of Orthodontists

President, Elmer S. Linderholm - - - - - - - - - - 1558 Humboldt St., Denver, Colo.
Vice-President, Ernest T. Klein - - - - - - - - - - 632 Republic Bldg., Denver, Colo.
Secretary-Treasurer, Curtis E. Burson - - - - - - - 1232 Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, E. C. Lunsford - - - - - - - - - - - - - 2742 Biscayne Blvd., Miami, Fla.
Secretary-Treasurer, Frank P. Bowyer - - - - - - Medical Arts Bldg., Knoxville, Tenn.

Southwestern Society of Orthodontists

President, Nathan G. Gaston - - - - - - - - - - - - Bernhardt Bldg., Monroe, La.
Secretary-Treasurer, Marion A. Flesher - - - - Medical Arts Bldg., Oklahoma City, Okla.

American Board of Orthodontics

President, Joseph D. Eby - - - - - - - - - - - - - 121 E. 60th St., New York, N. Y.
Vice-President, Stephen C. Hopkins - - - - - - - - 1726 Eye St., N. W., Washington, D. C.
Secretary, C. Edward Martinek - - - - - - - - - - 661 Fisher Bldg., Detroit, Mich.
Treasurer, Reuben E. Olson - - - - - - - - - - - - 712 Bitting Bldg., Wichita, Kan.
Raymond L. Webster - - - - - - - - - 133 Waterman St., Providence, R. I.
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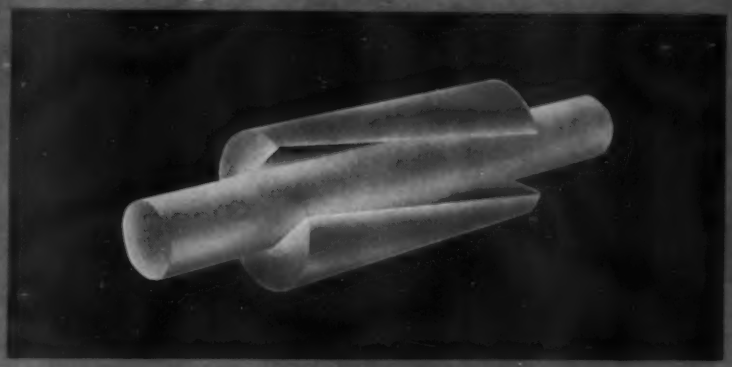
Ernest L. Johnson - - - - - - - - - - 450 Sutter St., San Francisco, Calif.



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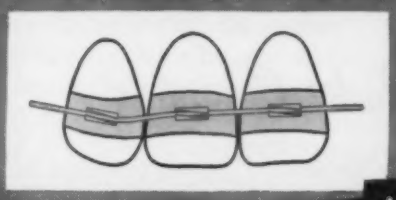

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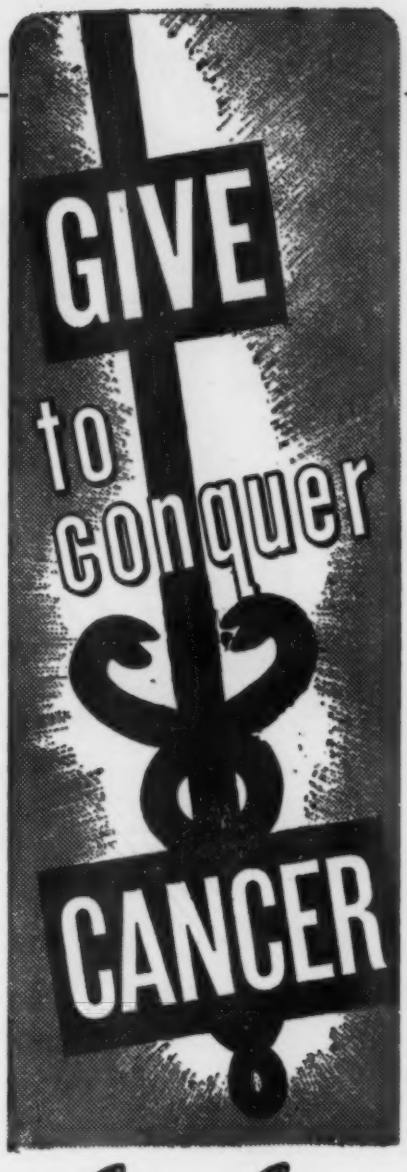

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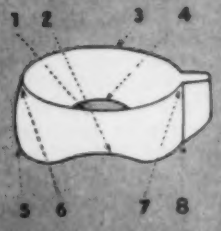

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